Chapter 19. The Animal Bones

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I. Methodology

Subsequent to the initial assessment of all the animal bones, bones from 420 contexts were selected for detailed analysis. All bones and teeth recovered by hand from these contexts were recorded individually onto a relational database (Microsoft Access), which forms part of the site archive. In the main table, where appropriate, the following information was recorded for each specimen; context; species; anatomical element; zone(s) of bone present; approximate percentage of bone present; observations of preservation (*e.g.* gnawing damage; erosion; weathering; charring; concretions; modern breaks); fusion data; associated bone group number; sample number; any pathology and other comments. Separate tables linked to the main table by an individual identification number were created for metrical, butchery and tooth ageing data. Where necessary, identifications were confirmed by reference to the comparative skeleton collection housed in the School of Applied Sciences, Bournemouth University. The bird bones were identified using the expertise and extensive reference collections in of Sheila Hamilton-Dyer supported by relevant identification manuals. Tooth eruption and wear descriptions for cattle, sheep/goat and pig follow the method of Grant (1982). Most measurements for mammals and birds are those recommended by von den Driesch (1976). Unidentified mammal fragments from hand-collected material were counted but not subdivided into size categories. Unidentified mammal bones from sieved samples were not counted. Two main methods of species quantification were employed. The first consisted of counts of the number of individual specimens (NISP). The second involved estimating the minimum number of each element represented (MNE). These were based on the most common zone present. Counts took into account how many bones of each element were represented in the skeleton. The norm is two (one left and one right). In the case of cattle and sheep first, second and third phalanges, where there are eight in each skeletons, the raw counts were divided by four. In the case of the atlas and axis, the raw counts were multiplied by two and so on.

II. Site Narrative

Phase 1 - early 1st century AD to early 2nd century AD

Group 4: Enclosure ditches

Nineteen contexts produced an animal bone assemblage of 80 fragments (NISP – number of individual specimens). These include 52 identified elements dominated by those of cattle (38). Small numbers of sheep/goat (6), pig (5), cat (2) and dog (1) were also recovered. Six fragments from at least three cattle mandibles were recorded. At least three cattle humeri are also represented. The cat remains consist of a pair of humeri from an immature animal. Most of a dog skull was recovered.

Group 5: Enclosure ditch

A single unidentified mammal fragment was recovered.

Group 12: Structural features/truncated gully.

The only animal bones consist of fragments of cattle pelvis and tibia from a gully.

Group 13: Structural gullies?

Thirteen animal bone fragments were recovered but only a single cattle tooth was identified to species.

Group 17: Ditches

Three contexts produced a total of 29 animal bone fragments. Cattle (10), sheep/goat (9) and pig (1) were identified. At least two cattle maxillae and a complete tibia are represented. A horned sheep skull fragment was also recovered.

Group 18: Structural/roundhouse gullies?

Seventeen animal bone fragments were recovered from a ditch. These include elements of sheep/goat (7), cattle (6) and pig (1). A radius from a neonatal sheep/goat was recovered but generally bone preservation was quite poor.

Group 22: Post-built building

Six contexts produced a total of 29 animal bone fragments. However, preservation was quite poor and only eight fragments were identified. Sheep/goat (4), cattle (2) and horse (2) were present. The horse elements consist of a complete third metacarpal and one of the associated splint bones.

Group 29: Roundhouse gully

Only six animal bone fragments were recovered from three contexts. These include sheep/goat (2) and cattle (1).

Group 35: Enclosure ditch

Seven contexts produced a total of 113 animal bone fragments, of which 36 were not identified. Cattle (40), sheep/goat (21), horse (8), pig (7) and mute swan (1) were identified. Fragments of cattle (7) and sheep/goat (7) mandibles are quite common, with at least three and six different mandibles represented respectively. The shaft of a cattle ulna had been fashioned into a point. The swan bone consists of a complete carpometacarpus.

Group 37: Roundhouse gully?

Five animal bones were retrieved from the same context. Sheep/goat (2), horse (2) and cattle (1) are represented. These include a horn core of an immature female goat and an almost complete worked sheep metatarsal.

Group 46: Group of pits

A total of 58 generally well preserved animal bones were recovered from six contexts. Sheep/goat (17), cattle (11), pig (2) and mallard (1) were identified. Most (12) of the sheep/goat elements are upper limb bones and at least three bones are represented by seven tibiae fragments. Three bones of juvenile sheep/goat and a humerus of a very young calf were recovered.

Group 47: Enclosure ditch

Three contexts provided 47 animal bone fragments including 21 of unidentified mammal. Sheep/goat (14), cattle (11) and dog (1) were the only species identified. At least two bones were represented by fragments of sheep/goat mandible and humerus and by cattle scapulae.

Group 83: Feature on edge of excavation – structural?

Two sheep/goat tibiae fragments, a cattle scapula and a fragment of unidentified mammal were the only bones recovered from two contexts.

Group 85: Ditch

Two contexts produced 36 animal bone fragments but only 14 were identified. Cattle (6), pig (4) sheep/goat (3) and domestic fowl (1) are present. The pig bones included two butchered mandibles.

Group 87: Pits

A total of 56 fragments were recovered, including 22 identified to species. Most of these belonged to sheep/goat (17), with pig (3) and cattle also represented. The sheep/goat assemblage includes five tibia fragments from at least three bones. Seven of the sheep/goat bones from Trench 2 (31) are charred as are 12 unidentified mammal fragments from that context.

Group 88: Pair of pits

Ten mammal bone fragments were recovered from two contexts. None could be identified to species.

Group 89: Structural gully?

Only six animal bone fragments were recovered including cattle (2) and sheep/goat (1).

Phase 2 – early 2nd century AD to early 3rd century AD

Group 1: Enclosure ditches

Four ditch contexts produced a total of 52 animal bone fragments. These include cattle (16), sheep/goat (7), medium-sized duck (2), pig (1) and horse (1). A substantial portion of the back of a cattle skull with horn cores still attached was recovered. Butchery evidence indicates that at least one of the horns had been removed and the skull had been skinned. The cattle assemblage also includes three largely complete metacarpals from immature animals and two

substantial portions of mandible. At least two bones are represented by three sheep/goat tibiae fragments. The duck radius and carpometacarpus could have belonged to the wing of the same adult bird.

Group 2: Enclosure ditches

Nine contexts produced 59 animal bone fragments including those identified as sheep/goat (15), cattle (13), pig (3) and dog (1). The sheep/goat assemblage includes four metacarpal and three radius fragments from at least two bones.

Group 6: Enclosure ditch

Four gully fills provided an assemblage of 72 animal bone fragments including cattle (18), sheep/goat (12), pig (3), horse (2) and dog (1). Three substantial portions of cattle metacarpal from at least two different bones were recovered. At least two cattle radii are also represented. The sheep/goat assemblage includes five radii and three tibiae fragments. Fragments of two different pig mandibles were recovered.

Group 10: Line of post pits/post-holes

Five post pit fills produced a total of 16 animal bones fragments. Only sheep/goat (5) and pig (1) were identified. Four of the sheep/goat elements, including three from the same context, are from four different humeri. Mandible fragments of a sow and a sheep were also identified.

Group 14: Ditch

Twenty animal bone fragments were recorded from a single context. Cattle (5), sheep/goat (1), pig (1) and a burnt antler fragment of red deer are represented.

Group 20: Enclosure/trackway ditches

Five contexts produced a total of 98 animal bone fragments, of which 42 were recorded as unidentified. Sheep/goat (27) and cattle (23) are well represented and pig (5) and horse (1) are also present. At least three mandibles, tibiae and humeri of sheep/goat are represented. There is also a complete sheep metacarpal. A radius of a neonatal animal was also recovered. At least three different cattle mandibles are represented by quite large portions of the jaws. A complete radius and metatarsal were also recovered, both of which had been butchered. A substantial part of a gnawed pig's skull was recovered. A boar's lower canine (SF189) has evidence for its wear surface being artificially expanded.

Group 21: Roundhouse gully

Nineteen animal bone fragments were recovered from a single context. These include cattle (7), sheep/goat (2) and pig (1). Three different cattle ulnae are present.

Group 31: Group of post-holes

Only eight animal bone fragments were recovered from four contexts. Sheep/goat (4) and cattle (2) were the only species identified.

Group 33: Group of post holes

A large cattle ulna and tooth from separate contexts were the only animal remains recovered.

Group 36: Ditch

Two contexts produced ten animal bone fragments, including cattle (3), sheep/goat (3), pig (1) and horse (1).

Group 40: Ditch

Bones were recovered from eight contexts producing a total of 40 fragments. Sheep/goat fragments (13) were the most commonly identified and cattle (6), horse (2), pig (1) and dog (1) are also represented. At least two different sheep/goat radii are represented. Two horse tibiae are present including one complete specimen. Two substantial portions of cattle metatarsal also survived despite gnawing damage.

Group 42: Enclosure ditches

Three contexts produced a total of 31 animal bone fragments. Cattle (7), sheep/goat (6), pig (2) and domestic fowl (1) were identified. Many of the bones have been gnawed. At least two cattle tibiae are represented.

Group 48: Structural gullies?

One gully produced ten animal bone fragments, of which only three sheep/goat elements were identified.

Group 54: Pit

Three contexts produced 12 animal bone fragments. Only cattle (4), sheep/goat (1) and dog (1) were identified. A fairly large portion of a butchered cattle mandible was retrieved.

Group 60: First cobbled surface/floor in Areas 4 and 5

Twelve unidentified mammal fragments were the only bones recovered from four contexts.

Group 61: Cobbles/floor in Building G39

Two fragments of cattle and one of pig were the only bones recovered.

Group 62: Occupation deposits above early cobbles in Areas 4 and 5

Thirteen contexts produced a total of 92 animal bone fragments. Sheep/goat (25) were the most frequently identified followed by cattle (14), pig (8), horse (1) and dog (1). Six sheep metacarpal fragments from at least four bones were recovered. At least three different tibiae are also present. The cattle assemblage includes a complete scapula. A humerus of a neonatal foal was also retrieved. A worked offcut of a large mammal longbone was also found.

Group 63: Occupation deposits in southern building G39

Three contexts produced a total of 12 animal bone fragments. Only sheep/goat (4) and cattle (1) were identified. The shaft of a bone pin made from a large mammal longbone was also recovered.

Phase 3 - Early 3rd century AD to late 3rd/early 4th century AD

Group 3: Enclosure ditch

Fourteen contexts produced a total of 110 animal bone fragments, of which 47 are unidentified. The identified material is dominated by cattle (41), followed by sheep/goat (14), horse (5), dog (2) and pig (1). The cattle assemblage includes five mandible fragments from at least three jaws. Seven vertebrae, some fairly complete, were also recovered. Fragments of two different sheep/goat femora are present.

Group 7: Enclosure ditches

Five contexts produced a total of 33 animal bone fragments including those identified as sheep/goat (7), cattle (3), dog (2) and pig (1).

Group 19: Enclosure ditch

Five contexts produced a total of 63 animal bone fragments. Cattle (25) were the most commonly identified followed by sheep/goat (11), pig (3), horse (2) and domestic fowl (1). The cattle assemblage includes eight mandible fragments from at least four jaws and fragments of at least three different scapulae and femora. A skull fragment of a neonatal calf was also recovered. At least two different sheep/goat radii and metatarsals are also represented. A complete horse metatarsal was also found.

Group 32: Line of post pits with stone packing

Three of the post pits produced a total of 13 animal bone fragments including those of sheep/goat (3), cattle (2) and pig (1). These include a complete cattle scapula.

Group 38: Ditch

Three contexts produced 60 animal bone fragments dominated by cattle (23) with sheep/goat (6), pig (5), horse (2) and dog (1) also identified. Four cattle scapulae fragments belonged to at least two bones. Two different sheep/goat tibiae are also represented.

Group 41: Oven

An unidentified mammal fragment was the only animal bone recovered.

Group 43: Enclosure ditch

Four contexts provided a total of 106 animal bone fragments. The identified assemblage was dominated by cattle (34) and sheep/goat (22). Pig (4) and horse (1) are also present. Nine cattle mandible fragments belonged to at least three jaws. Four zygomaticus fragments from at least two cattle skulls were also recorded. A fairly complete sacrum and lumbar vertebra belonged to the same animal. A complete cattle metacarpal was also found. Five sheep/goat mandible fragments belonged to at least three jaws.

Group 45: Enclosure ditch

Forty-five animal bone fragments were recovered from a single context. Cattle (13), sheep/goat (5) and pig (1) are the only species definitely present. Four cattle mandible fragments belonged to at least two jaws. A fairly complete cattle skull was also recovered. This shows signs of weathering and no teeth were recovered, indicating that the skull was a secondary deposition. Although the absence of teeth may reflect a collection bias, it is most unlikely that the excavators would have overlooked objects the size of cattle upper molars.

Group 51: Well

Three contexts produced eleven cattle elements. No other bone fragments were recovered. Five cattle mandible fragments belonged to at least three jaws. Three of the mandibles bear butchery marks. Two substantial portions of scapulae were also found.

Group 55: Structural gullies?

Seventeen animal bone fragments were recovered from two contexts. Only sheep/goat (4) and a charred horse metatarsal fragment were identified.

Group 64: Occupation deposits in Area 2 predating main building G65

Seventeen occupation layers produced a substantial animal bone assemblage of 273 fragments. Although cattle (62) and sheep/goat (53) dominated the assemblage, pig (20) was quite well represented and dog (2), horse (2) and hare (1) are also present. Six bird bones were recovered, of which three belonged to domestic fowl and one to a medium-sized duck. Two bird bone fragments remain unidentified, although one could have been from a mallard-sized duck. Amongst the cattle assemblage at least three bones are represented by fragments of calcaneus, mandible, premaxilla, axis and radius. Eight cattle phalanges were recovered including three first phalanges with skinning marks. At least three bones are represented by fragments of sheep/goat femur, mandible and radius and at least five different bones are represented amongst the ten tibiae fragments. Ten sheep/goat radius, nine metacarpal and seven metatarsal fragments were also identified. At least two different pig scapulae and ulnae are present. Two chicken humeri were also found.

Group 65: Main building (bath house?)

Only ten animal bone fragments were retrieved from two contexts. Sheep/goat (2) and cattle (2) are the only species definitely present.

Group 66: Cobbled/paved surface mostly to south and west of main building G65

Nineteen animal bone fragments were recovered from a single context. There were identifications of cattle (6), sheep/goat (4) and horse (1). Four of the cattle bones bear butchery marks.

Group 67: Later limestone paving in Area 5

Seven contexts a produced a total of 91 animal bone fragments. Cattle (20), sheep/goat (11), pig (5), horse (1) and dog (1) were identified. At least two cattle metacarpals and scapulae, and two sheep/goat tibiae are present. The unidentified mammal material includes a splintered large mammal longbone fragment discarded as waste and a peg (SF187) also made from the shaft of a large mammal longbone.

Group 68: Make-up for main building G65

Only four animal bones were recovered. A pig scapula was the only element identified.

Group 78: Ditch?

Four ditch fills produced a total of 58 animal bone fragments. The identifiable material was dominated by a partial skeleton of an immature dog (28). Most of the major bones of the left hand side were recovered, along with the skull, mandibles, pelves, scapulae and a few of the vertebrae and ribs. Few bones of the feet were recovered. No baculum was recovered so it is possible that this was a female (Table 19.7), although as this was only a partial skeleton, it is possible that any baculum was not recovered. Other species represented are cattle (5), sheep/goat (3) and pig (2). These include three fragments of cattle pelvis.

Group 81: Gully

Four contexts produced 35 animal bone fragments with the identified portion dominated by sheep/goat (12). Cattle, pig and dog are each represented by a single specimen. The sheep/goat assemblage includes four tibiae fragments from at least three bones.

Group 93: Pit

Seventeen animal bone fragments were recovered from a single context. Of the ten identified to species, five belonged to sheep/goat, four to cattle and one to pig. Three different sheep/goat mandibles are present.

Phase 4 - Late 3rd/early 4th century AD to late 4th century AD

Group 8: Enclosure ditch

Seven contexts produced animal bones providing a total assemblage of 143 fragments, of which 84 remain unidentified. Cattle (30) and sheep/goat (20) dominate the identified material with small numbers of pig (5), horse (2), dog (1) and domestic fowl (1) also present. Seven cattle mandible fragments came from at least three jaws and at least three different scapulae are represented amongst the six fragments recorded. The five sheep/goat mandible fragments are all from different jaws. Five tibiae fragments were also recorded. A fairly complete horse skull was recovered. A pin shaft is included amongst the unidentified mammal material.

Group 15: Pit

Three contexts produced 30 animal bone fragments. Cattle (9), sheep/goat (5), horse (3), pig (2), and cat (1) are represented. A complete cattle femur was recovered as well as two substantial portions of mandibles. Two fairly complete horse metatarsals were also found.

Group 34: Group of pits

Three contexts produced 57 animal bone fragments, of which 41 are unidentified. Sheep/goat elements (10) were the most commonly identified with cattle (3), pig (2) and cat (1) also represented. A sheep/goat tibia has evidence of being worked, having been perforated near the distal end.

Group 44: Enclosure/trackway ditches

Six contexts produced 57 animal bone fragments. Cattle (11), sheep/goat (10), pig (4), horse (3) and dog (1) are represented. The cattle assemblage includes three fragments of humerus from different bones and a fairly complete scapula. Two different sheep/goat mandibles are also present.

Group 52: Pit

Eight of the pit fills produced animal bones providing a substantial assemblage of 291 fragments. The identified material was dominated by cattle (86) and sheep/goat (54) with small numbers of pig (8), dog (2), horse (2), goose (1) and duck (1) also recorded. Fifteen fragments of cattle scapulae belong to at least nine bones. Two complete cattle metacarpals were recovered and three bones of neonatal calves were also retrieved. Ten sheep/goat mandible fragments are derived from at least six jaws and nine radius fragments are from at least four different bones.A split and whittled shaft of a large mammal longbone provides evidence of boneworking.

Group 57: Ditch?

Seven contexts produced a total of 117 animal bone fragments including those identified as cattle (45), sheep/goat (17), pig (8), horse (2), dog (1) and pigeon (1). The identification of pigeon needs to be verified, in the light of information in Tomek and Bochenski (2009). The cattle assemblage includes ten mandible fragments from at least five jaws and a complete metacarpal and metatarsal. At least three scapulae and ulnae are also represented. The pig assemblage includes three mandible fragments from different jaws. A horse mandible has evidence of bit wear on the second premolar.

Group 69: Occupation deposits surrounding main building G65

Five layers produced a total assemblage of 60 animal bone fragment, of which 40 are unidentified, indicative of the heavily fragmented nature of the assemblage. Sheep/goat (9), cattle (7), pig (2), horse (1) and a red deer first phalanx were identified.

Group 70: Occupation deposits within main building G65

Four layers provided just fourteen animal bone fragments, including those of sheep/goat (5), cattle (2) and pig (1).

Group 72: Late occupation deposits in Area 5

Six occupation layers provided a substantial assemblage of 249 animal bone fragments, although 141 of these are unidentified reflecting the heavily fragmented nature of the bones. Cattle (60), sheep/goat (38), pig (4), horse (4), badger (1) and domestic fowl (1) are present. The cattle assemblage includes six associated cervical vertebrae and five thoracic vertebrae could also have belonged to this group. Most of these vertebrae have been gnawed and there are butchery marks on the atlas, indicating that these bones have been disturbed in situ or, more likely, represent a

redeposited group. Six cattle femora fragments come from at least four different bones and at least five metatarsals are represented by six fragments and four radii by five fragments. Twelve of the sheep/goat fragments are from metapodials. At least three radii and tibiae are represented by seven and six fragments respectively. A pin (SF57) probably made from the shaft of a sheep-sized mammal longbone was also recovered.

Phase 5 - Very late Roman or Saxon?

Group 56: Structural gully?

A posthole produced five animal bone fragments including a metacarpal of a neonatal calf and the radius and ulna of an adult sheep.

Group 73: Destruction fill within hypocaust

Seven contexts produced a large, well preserved and very distinctive faunal assemblage. Altogether, 1,317 animal bone fragments were recovered. These were dominated by sheep/goat (792). This assemblage is dominated by mandible (112), skull (89), metacarpal (78) and metatarsal (72) fragments. In terms of the minimum number of elements represented, there are at least 52 different metacarpals, 49 metatarsals and 42 mandibles. Upper limb bones are less well represented although far from absent. At least 21 tibiae, 18 radii, 17 scapulae, 14 humeri and 12 femora are represented (Table 19.4). Many of the bones are complete but there are butchery marks on some of them, indicating that at least some of the carcasses were processed. The vast majority of the bones belonged to immature sheep. Most of the unidentified material consisted of rib shafts and other sheep-sized fragments, which were derived from these same depositions. Further detailed analysis and interpretation of this group can be found in the second part of this report.

Cattle fragments (85) were the second most commonly identified. There is a more even distribution of elements than in the sheep/goat assemblage, although phalanges (15) are unusually well represented and the bones are generally more fragmented, although four fairly complete metacarpals and three metatarsals of immature cattle were recovered. At least five bones are represented by seven scapula fragments. Ten fragments of mandible belonged to at least four jaws and at least five different bones are represented by eight pelvis fragments (Table 19.3). Most of the cattle are also from immature animals and several neonatal calf bones were recovered.

Only 17 pig fragments were identified including three from neonatal animals. Most of the elements are from the head or feet (Table 19.5). Six bones of cat were identified, five of which were from the same context and could have belonged to the same adult. Only four horse elements were recorded, only two of which were in the same contexts as the bulk of the sheep assemblage.

Bird bones (49) are better represented than in other deposits. Twenty-one domestic fowl bones include five tibiotarsi. Goose bones (18) are also more abundant than in previous assemblages. At least two adult birds are represented. All five corvid bones are a good match for jackdaw and could have belonged to the same bird. Other avian species identified were mallard (1) and medium-sized duck (1).

Group 74: Destruction layers outside main building G65

Eight layers produced a total of 62 animal bone fragments. Sheep/goat (16), cattle (14), domestic fowl (2) and pig (1) were identified. The sheep/goat assemblage includes five metatarsal fragments and two substantial portions of mandibles. Two different cattle metatarsals are represented and there are two bones from neonatal calves.

Group 75: Destruction fill within main building G65

Seven destruction layers produced 50 animal bone fragments including those identified as cattle (11), sheep/goat (11), pig (4), cat (4) and goose (1). The cattle assemblage includes four mandible fragments. The cat bones were all found in the same context and could have belonged to the same adult animal.

Group 76: Destruction layers in Area 4

Twenty-two layers provided an assemblage of 123 animal bone fragments. The assemblage is dominated by cattle (36) and sheep/goat (21). Small numbers of horse (5), dog (2), and domestic fowl (2) are also represented. The cattle assemblage includes seven scapulae fragments from at least four bones and four fragments of different femora. Five fragments of sheep/goat tibiae are derived from at least two bones. Two sheep/goat humeri and mandibles are also represented. Two sets of horse radii and ulnae are also present.

Group 77: Destruction layers in Area 5

Eight layers produced 119 animal bone fragments dominated by cattle (40) followed by sheep/goat (16), pig (6) and horse (4). There is a fairly even representation of cattle elements with three different bones represented by four metacarpal fragments.

Group 79: Robber trenches in Area 2

Nine contexts provided a sample of 47 animal bone fragments but only sheep/goat (11) and cattle (8) were identified. These include five cattle mandible fragments.

Group 80: Robber trenches in Area 4

Twelve contexts produced a total of 32 animal bone fragments including those of sheep/goat (6), cattle (4), pig (1) and pigeon (1).

Group 86: Post-hole

Only four animal bones were recovered including sheep/goat (2) and pig (1).

III. Discussion

Recovery and limitations of analysis

The assemblage is relatively large and the assessment indicated that it had considerable potential for analysis. However, this was offset to some extent by the fact that the material was apparently all hand-collected; therefore it is likely that some of the bones of fish, amphibians, wild birds and small mammals, if they were present, were overlooked. This restricts discussion on the characteristics of local habitats. The analysis also indicated that some of the smaller bones of the larger mammals may also be under-represented. The interpretation of the structural data was also limited, for reasons discussed in Chapter 1.

Preservation

Of the assessed assemblages of animal bones from this site, bones from 341 contexts were chosen for detailed recording and analysis. These have provided a sample of 4,823 fragments, of which 2,766 (57%) were identified (Table 19.1).

Gnawing damage was recorded on 542 (21%) of the identified species elements excluding loose teeth. This figure ranges between 29% and 33% in Periods 1-4 (Table 19.2). These high percentages show that the assemblage has been severely modified by scavengers, mainly by dogs, although cat tooth marks were observed on a few of the bird bones. The bones of sheep/goat, pig and bird are more likely to have been completely destroyed than those of cattle and horse, particularly their more fragile bones. Their numbers are therefore likely to be under-represented in the surviving assemblage. Gnawing damaged decreased in the Period 5 assemblages and is very low indeed amongst the large assemblage (G73) from the hypocaust destruction fill. This strongly suggests that most of the bones were dumped directly into this building and were not accessible to dogs.

The percentages of gnawed elements of cattle, sheep/goat (excluding G73) and pig are closely comparable, ranging between (28% - sheep/goat and 40% - cattle), suggesting that the bones of the major domestic mammals, including horse, had similar depositional histories and were accessible to scavengers in most periods.

Surface erosion was recorded on 188 (7%) of the identified elements excluding loose teeth (Table 19.2). Most of this erosion was not severe. The assemblages from Period 4 and G73 had the lowest percentages of eroded bones. Weathered elements distinguished mainly by longitudinal cracks are indicative of bones being exposed after initial deposition. Overall, 81 (3%) of the identified fragments were recorded as weathered. They are notably absent from G73, which again indicates that these bones were swiftly buried and protected from the elements (Table 19.2).

Only 1% of the identified elements showed evidence of burning. In addition, 28 (1%) of the unidentified fragments were also burnt (Table 19.2). Slightly higher percentages of bones damaged by fire were found in Periods 1 and 3 than in other assemblages.

Species Representation

The identified elements are composed of at least nine mammal and seven bird species. No bones of fish or amphibians were recovered. The sheep/goat category includes 331 elements diagnostic of sheep and only two as goat (Table 19.1). It is assumed therefore that the great majority of the rest of the sheep/goat elements belonged to sheep. 'Horse' bones could also conceivably include mules. However, the latter were not positively identified. However, the latter were not

positively identified using the limited amount of metrical data available to distinguish between these species (Johnstone 2004).

Phase 1 - early 1st century AD to early 2nd century AD

A total of 281 identified fragments were recovered. Of the 278 mammal fragments, cattle (48%) are the most common, followed by sheep/goat (38%), pig (8%), horse (4%), dog (0.7%) and cat (0.7%). High percentages of cattle have been found in similar fairly small samples from other Late Iron Age-Early Romano-British sites in Bedfordshire, for example, Marsh Leys Farm (58%) (Maltby 2011), Shefford (51%) (Maltby 2010b) and Biggleswade (54%) (Maltby forthcoming, a). The percentage of cattle in the contemporary assemblage from the two farmsteads investigated at Biddenham Loop (35%) was significantly smaller (Maltby 2008). High percentages of cattle are often found in the ditches of Iron Age and Romano-British enclosures and it should be noted that the great majority of this sample derived from such features. The sheep/goat assemblage includes a horn core of a female goat but several other diagnostic bones were recorded as sheep (Table 19.1). Low percentages of pig bones are a feature of Iron Age and Roman samples from Bedfordshire. They usually have contributed less than 10% of the animal bone NISP counts in assemblages investigated in recent years. Their highest percentage (13%) was obtained from a small assemblage from Shefford. Therefore this is a relatively high percentage for this species in the area. The percentage of horse fragments is slightly lower than at Biddenham Loop (9%), Biggleswade (10%) and Marsh Leys Farm (8%) but comparable to the contemporary assemblage at Shefford (4%). The presence of cat bones is quite unusual at this early date from the region. It was not recorded in any of the samples cited above. The species was present in the Roman sample obtained from North Brickhill (Maltby forthcoming, b).

Only three bird bones were identified. These include a bone from domestic fowl. This species was originally imported into Britain probably in the later Iron Age, although it is not found in large numbers, if at all, on most Iron Age sites. It has been found in varying quantities on different types of Romano-British settlement, usually more commonly in towns, military sites and, to a lesser extent, villas (Maltby 1997). Chicken bones have been recorded on other Late Iron Age and early Romano-British deposits from Shefford (Maltby 2010b) and two skeletons were recovered from an early Romano-British deposit at Marsh Leys Farm (Maltby 2011a). The carpometacarpus of a mute swan (*Cygnus olor*) is an unusual find. The species has not been recorded on any of the prehistoric and Roman sites investigated in recent years in Bedfordshire. Swan bones have been recorded in very small numbers in Romano-British urban samples from York, Lincoln, London and Wroxeter (Maltby 2010a, 278) and on a handful of other Roman sites mainly in southern England (Parker 1988; Yalden and Albarella 2009, 109). Mallard (*Anas platyrhynchos*) has been found more commonly on Roman sites (Parker 1988; Albarella 2005; Yalden and Albarella 2009, 104-105; Maltby 2010a, 274-275).

Phase 2 – early 2nd century AD to early 3rd century AD

A sample of 568 animal bone fragments included 296 that were identified to species. In contrast to the previous phase, bones of sheep/goat (44% of the mammal NISP counts) and cattle (42%) were found in roughly equal amounts. The percentage of pig bones (10%) increased slightly, whereas horse (3%) and dog (2%) are poorly represented. Red deer is represented only by an antler fragment. It is rare for sheep/goat elements to outnumber those of cattle on Romano-British sites from Bedfordshire. Cattle elements have usually provided over half the identified mammal assemblages in Roman phases from Marsh Leys Farm (Maltby 2011), Clapham (Maltby forthcoming, c), North Brickhill (Maltby forthcoming, b), Kempston Church End (Roberts 2004) and Shefford (Maltby 2010b). Biddenham Loop is an exception. There, cattle (44%) and sheep/goat bones (37%) were found in fairly similar amounts in the assemblage from the Romano-British farmsteads (Maltby 2008). As noted above, Roman assemblages from Bedfordshire containing more than 10% pig fragments are rare, although the percentages of pig from this period are only slightly higher than those from Roman deposits at Biddenham Loop (8%) and Kempston (9%).

Whether the changes in species proportions represent a significant change in the diet is, however, unclear. In the sample of 203 fragments from groups derived mainly from ditches, cattle fragments (45%) outnumbered sheep/goat (41%). Pig (8%), horse (3%), dog (2%) and red deer (0.5%) are also represented. In a sample of 90 fragments features from pits and deposits associated with structures and occupation levels, sheep/goat (48%) are comfortably better represented than cattle (36%). The percentage of pig (13%) is slightly higher and horse (1%) and dog (1%) slightly lower. It is possible that relatively more sheep and pig bones were processed and deposited in areas more central to domestic activities of cooking and eating. Unfortunately the samples are too small to provide conclusive evidence.

Two bones of medium-sized duck were recorded. It has not been possible to identify these to species, although they are quite a good match for wigeon (*Anas penelope*). A single bone of domestic fowl was also recovered.

Phase 3 - Early 3rd century AD to late 3rd/early 4th century AD

A larger assemblage of 966 animal bone fragments includes 518 identified elements. These provide typical a pattern of species representation for Roman sites in Bedfordshire with cattle (52%) providing over half of the identified mammal

assemblage (excluding articulated bones of dog), followed by sheep/goat (only sheep definitely identified) (33%), pig (9%), horse (3%) and dog (2%). A single bone of hare was also recorded.

There is again some spatial variation in the relative abundance of bones recovered. From enclosure ditches, cattle provide 59% of the mammal assemblage followed by sheep/goat (28%), pig (7%), horse (4%) and dog (2%). In occupation layers and other deposits associated with or adjacent to buildings, cattle (42%) and sheep/goat (41%) are much more evenly represented. Pig (13%) are again better represented in such deposits whereas horse (2%) decreases. Dog (1%) and hare (0.5%) complete the assemblage. Eleven cattle were the only bones identified in the fill of a disused well. This demonstrates again that the relative abundance of species depends to an extent on the areas and the types of features excavated. Differential preservation of bones in different types of feature, and spatial variations in processing and deposition of bones of different species are both likely to have played a part in creating this variability. However, cattle percentages are greater in both the ditch and other assemblages compared with the equivalent features in Phase 2, so there is a possibility that beef consumption became more important during this period. However, samples sizes are quite small.

Four bones of domestic fowl and one of a medium-sized duck were recovered. All but one of these bones was found in occupation deposits.

Phase 4 - Late 3rd/early 4th century AD to late 4th century AD

An assemblage of 1,018 fragments includes 488 identified to species. Overall percentages of identified mammal fragments are similar to those of Phase 3 with cattle providing 52% of the total, followed by sheep/goat (35%), pig (7%), horse (4%), dog (1%), cat (0.4%), red deer (0.2%) and badger (0.2%). There is slightly less variability in species representation in different types of feature than in previous phases. Cattle fragments provide 54% of the identified mammal fragments in ditches, 51% in occupation deposits and 52% in pit fills. Sheep/goat (only sheep definitely identified) are, however, again less well represented in ditches (29%) than in occupation layers (39%) and pits (37%). Unusually, pig elements are better represented in the ditches (11%) than in occupation layers (6%) and pits (6%). Their overall percentage, however, is similar to previous phases. Horse continues to be generally poorly represented and is slightly less well represented (3%) in pits than in the occupation layers (4%) and ditches (4%).

The assemblage from this phase has a slightly more diverse range of species than earlier phases. In addition to the small numbers of dog, cat, red deer and badger bones, four species of bird are also represented. These include two bones of domestic fowl and one each of goose, duck and pigeon. This is the earliest appearance of goose on the site. The bone is a good match for domestic/grey lag goose (*Anser anser*). The duck bone is comparable in size to a wigeon. The pigeon bone is a good match for domestic pigeon/rock dove (*Columba livia*) using the extensive reference collections available, although the possibility that they belonged to stock dove or woodpigeon cannot be totally ruled out (Tomek and Bochenski 2009).

Phase 5 Group 73 - Very late Roman or Saxon?

The large assemblage from the hypocaust destruction fill has been treated separately because of its distinctive nature. It has already been established that the assemblage is much better preserved than bones from other phases (Table 19.2). Sheep/goat provide 88% of the identified mammal bones, followed by cattle (9%). Pig (2%), cat (0.7%) and horse (0.4%) are all poorly represented. In terms of minimum numbers of elements, at least 52 (84%) different sheep metacarpals are represented, from a minimum of at least 26 sheep. Cattle (8%), pig (3%), cat (3%) and horse (2%) complete the mammal assemblage. There is no doubt that this accumulation is mainly derived from the disposal of bones associated with the processing of sheep carcasses on a large scale.

Forty-six bird bones were recovered, mainly from domestic fowl and goose (Table 19.1). The increase in the incidence of goose may indicative that domestic birds were now being kept. The numbers of goose bones tend to increase in the later Roman period on British sites and are quite common on Saxon sites (Albarella 2005). Both mallard and a wigeon-sized duck are also present. All the jackdaw bones could have belonged to the same bird, which could have been a resident on the site and attracted to abandoned buildings.

Phase 5 Other Assemblages

A sample of 442 animal bone fragments includes 227 of identified mammals. Species representation is much more typical of assemblages from earlier phases than G73. Cattle provide 50% of the NISP counts followed by sheep/goat (37%), pig (6%), horse (4%), cat (2%) and dog (0.9%). Domestic fowl (4), goose (1) and pigeon family were the only bird species identified.

Element Representation

Tables 3-8 provide a summary of the different types of element identified for each of the mammal species represented. Two methods of calculation were carried out for the most common species. The first involves a count of specimens (fragments) identified to each type of element (NISP). The second method records the zones of each of the elements represented, enabling the determination of the minimum number of elements (MNE) present.

Cattle

Fragments of mandible, tibia and scapula are the most abundant in the Phase 1 assemblage with at least eight mandibles, six scapulae and five tibiae represented. At least five skulls are also present. Metapodials and phalanges are poorly represented in this assemblage (Table 19.3). Mandible and scapula fragments are also the most common in the Phase 2 sample but most limb bones are also well represented. At least seven metacarpals and ulnae and six mandibles and scapulae are represented, showing there is a fairly even balance between good and poor quality meat bones. Skulls are less well represented than in the previous phase.

The Phase 3 cattle assemblage includes a high percentage of mandible fragments. Skull and scapula fragments are also well represented. At least 17 mandibles and 14 scapulae are present. Skulls (9) are also quite abundant. These elements comfortably outnumber MNE counts of limb bones. Mandible and scapula fragments are also the most abundant in the Phase 4 assemblage. At least 14 scapulae and ten mandibles are present. There are also at least ten femora represented and other limb bones are fairly abundant. The cattle sample from G73 has quite an even spread of different bones, although mandible fragments are again the most abundant. Phalanges are better represented than in other phases. The cattle assemblage from other features in Phase 5 also includes high percentages of mandible and scapula fragments (Table 19.1).

There is no evidence for the large scale processing of cattle carcasses in any of the phases, although there are some variations in element abundance. Overall, at least 51 scapulae and 49 mandibles are present. Most of the other major elements have MNE counts of between 20 and 30. Mandibles and scapulae are usually very well represented in cattle assemblages, as some parts of the bones survive well and are easily identifiable. They are well represented in Roman deposits at Clapham, for example (Maltby forthcoming, c). The presence of so many scapulae, however, may suggest that some shoulders of meat were processed separately and perhaps include some joints imported to the settlement. However, the presence of large numbers of mandibles and skull fragments indicates that many of the cattle were slaughtered at the site.

Loose teeth comprise only 7% of the cattle NISP counts, which suggests that the overall preservation of cattle bones is good despite the prevalence of gnawing damage. However other smaller elements such as the carpals, tarsals and phalanges are also under-represented, suggesting some recovery bias. Vertebrae and ribs are also poorly represented, which is usual in fragmentary and predated assemblages.

Sheep/Goat

Sheep/goat assemblages that have abundant evidence for gnawing damage are usually biased towards the denser and larger elements such as the mandible, radius, tibia and metapodials. This assemblage broadly follows that pattern (Table 19.4). In each of Phases 1-4, fragments of mandible, tibia and radius are the three most common elements collected and metapodial fragments are also well represented. Upper limb bones, skull and pelvis fragments are consistently present in smaller numbers but vertebrae, carpals, tarsals and phalanges are very poorly represented, probably as a result of a recovery bias.

The G73 assemblage is much better preserved. This assemblage is dominated by mandible, skull, metacarpal and metatarsal fragments. Phalanges, particularly first phalanges, are much better represented than in other phases. Radius and tibia are comparatively poorly represented and other upper limbs even less so. In terms of MNE counts, there are at least 52 different metacarpals, 49 metatarsals and 42 mandibles. Only 21 tibiae, 18 radii, 17 scapulae, 14 humeri and 12 femora are represented (Table 19.4). Most vertebrae are also under-represented. This may partly be the result of poorer survival but is also likely to indicate that many were removed after initial butchery. This suggests that the major meat-bearing bones of many of the carcasses deposited here were taken elsewhere for consumption, either within the site or exported from it. Cervical vertebrae, particularly the atlas and axis are better represented than other vertebrae. The latter may often have been attached to the skulls after decapitation and deposited with them.

Other Phase 5 deposits produced a sheep/goat assemblage more typical of other phases with tibia and radius fragments the most abundant elements (Table 19.4).

Pig

The pig assemblage is too small for a detailed phase by phase analysis. Loose teeth provide 15% of the overall assemblage. Mandibles are the best represented element both in terms of NISP counts and MNE (15) scores (Table 19.5). As in the case of cattle and sheep/goat, pig mandibles are relatively robust and survive better than most other elements. However most of the major limb bones are quite well represented with at least ten humeri and femora and nine tibiae recorded. The smaller bones of the limb extremities, vertebrae and ribs are much less well represented. This again may be mainly a factor of differential retrieval and survival rather than necessarily reflecting the import of joints of ham and bacon.

Horse

The horse assemblage is also too small for detailed analysis. Overall, 15% of the assemblage consists of loose teeth. The higher incidence of teeth than from cattle may indicate that the larger loose teeth of horse are more likely to have been retrieved. Unusually, first phalanges are the best represented element and the presence of skinning marks on some of these (see below) may suggest that some horse hides were processed at the site. There is, however, a fairly even representation of different horse elements (Table 19.6).

Dog

Bones recovered from the partial skeleton found in a Phase 3 G78 ditch fill are listed in Table 19.7 along with dog elements found elsewhere in the excavations. Although only 28 bones of the immature skeleton survived, it is likely that it was originally deposited as a complete carcass either in the ditch, or more likely, elsewhere before being redeposited. There is no evidence for carcass dismemberment or skinning.

Other Mammals

Anatomical elements of other mammals are provided in Table 19.8. Two of the cat tibiae, one of the humeri and the mandible and femur may have belonged to the same skeleton from Phase 5 G73.

Bird

Bird remains are too few in number for detailed analysis. The domestic fowl assemblage (NISP = 33) includes nine tibiotarsus fragments, which is the largest bone in the skeleton and the most likely to be discovered. The absence of any of the adjacent tarsometatarsi is perhaps worth comment, as these are also quite large bones and would be expected to be found. They may have been routinely removed from the rest of the chickens during butchery. This raises the possibility that some of the birds may have been imported to the site. The bias towards wing bones in the duck, goose and swan remains is typical of unsieved archaeological assemblages, as these bones are larger than the bones of the legs. All the jackdaw bones are likely to have belonged to the same bird.

Butchery Evidence

Detailed individual records of butchery observations are available in the archive.

Cattle

Butchery marks were observed on 136 (15%) of the cattle elements. Higher frequencies of marks were found on bones with high meat value, particularly some of the vertebrae, scapulae and upper limb bones. They were also commonly recorded on first phalanges (Table 19.10).

The types of mark observed can be divided broadly into three main categories: incisions made with a knife; chop marks made with a cleaver; and marks made with a heavy blade. The relative abundance of such marks has been shown to vary on different types of Roman settlement with specialist butchers operating at some settlements producing distinctive patterns of butchery on cattle in particular. Generally the use of a cleaver in butchery operations increased during the Roman period, replacing traditional methods that relied more on the use of knives (Maltby 2007; 2010a).

The occurrences of different types of marks observed on each type of cattle bone in each phase are summarized in Table 19.11. Butchery marks on cranial elements apart from mandibles were fairly infrequent. They do include two examples of chop marks near the base of horn cores showing that the horns had been removed presumably for further processing. Incisions associated with skinning and flesh removal were found on a frontal and two maxillae. Heavier blade marks associated with flesh removal were found on four skull fragments, mainly on the zygomatic. These include an early example from Phase 1.

Butchery marks were found on mandibles from all phases. Most of these consist of incisions. These are most commonly located either on the ramus where the back of the jaw was separated from the skull or near the front of the mandibles on the diastema. Cleaver marks were observed on only four specimens, the earliest from Phase 3. The

prevalence of knife cuts contrasts with butchery evidence from major urban sites where cleavers were used systematically for processing mandibles (Maltby 2007; 2010a, 128-129).

Butchery marks on cattle scapulae were the most commonly observed. Those with blade marks begin to appear in Phase 2 and become the most common type of mark observed. These commonly appear at the base of the spine (see Maltby 2010a, 130 for a parallel). These marks may be associated with segmentation but others located on both the spine and other areas of the blade are clearly associated with filleting. Blade marks on scapulae are common on Roman specimens, particularly on military and urban sites, but have also been recorded on rural sites such as Owslebury and Winnall Down in Hampshire (Maltby 2007). Locally they have also been recorded at Marsh Leys Farm (Maltby 2011) and North Brickhill [Maltby forthcoming, b). They may represent evidence that some of the scapulae were being preserved by salting and smoking (Dobney 2001), perhaps by specialist butchers. The presence of one specimen from Phase 3 with a hole in the blade distinctive of being hung on a spike may support this. Some of these shoulders could have been imported to the site.

However, knife cuts, also mainly associated with filleting continued to be found on scapulae in all phases. They form a much high proportion of butchery marks than on urban sites such as Winchester (Maltby 2010a, 131), indicating that traditional methods of processing continued. Similarly, there was a variety of knife cuts, chop marks and blade marks evident on pelvis fragments.

Butchery marks were found on all of the major upper limb bones. Knife cuts were prevalent on cattle humeri, particularly on the medial aspect of the distal end. These are disarticulation marks with the knife being used to cut through the ligaments to release the humerus from the radius and ulna. Corresponding marks were observed on a radius and an ulna. This method is the one commonly carried out on Iron Age sites and continued to be practised into the Roman period. However, segmentation of this joint using a cleaver became the more usual method of butchery and marks associated with this process are found in abundance on urban sites (Maltby 2010a, 131-3). Cleaver marks associated with segmentation are evident on upper limb bones at Newnham, for example, on three of the proximal ulnae and two of the distal tibiae. However, knives continued to be used for this purpose in other cases. Heavy blade marks that removed scoops of bone as the blade was run along the shaft during filleting were observed on the shafts of a radius, three femora and a tibia (Table 19.3). This distinctive method of butchery was introduced to Britain by Roman specialist butchers (Maltby 2007). They are found in consistently large numbers in assemblages from major towns but are absent or much less common on other types of civilian settlement in southern England (Maltby 2007; 2010a, 131-137, 284-5). Blade marks were recorded on only 2% of the upper limb bones (humerus, radius, femur and tibia) in the Newnham assemblage, compared with figures consistently of around 20% in a number of urban samples. This low percentage is comparable to contemporary rural sites in Bedfordshire. Indeed, such marks are absent from the assemblages from Biddenham Loop, Shefford (Maltby 2007, 66) and Clapham (Maltby forthcoming, c). Only 4% of the upper limb bones at Marsh Leys Farm had blade marks, and several of these are fairly crude compared with those found on major urban sites (Maltby 2011). The same observation was made on several of the examples from Newnham. It suggests that specialist butchers were not operating to any great extent at the site.

A humerus (Phase 4) and a radius (Phase 5) have been split axially. The systematic practice of collecting together upper limb bones and splitting them longitudinally to release the marrow has been recorded on a number of Romano-British settlements. Again, the practice has been observed most frequently in towns and in some cases it is clear that these bones were processed on a large scale (Maltby 2007; Maltby 2010a, 284-5). They are much less abundant or completely absent on most rural sites where butchery has been analysed, although a large group of them has been found at Wortley villa in Gloucestershire (Maltby 2007: 68). In other sites that have been investigated in Bedfordshire in recent years, split upper limb bones are absent from all the assemblages apart from Kempston Church End (Maltby in press) and the assemblage from the small town at Ruxox (Hamilton-Dyer 2004, 299), indicating that specialist processing was in operation at those settlements but not regularly, if at all, on the other sites.

Very few butchery marks were observed on tarsals (ankle bones) but again both chop marks and knife cuts were recorded. Only knife cuts were observed on metacarpals. In two cases these marks were on the lower shaft and probably are related to initial skinning. The other three were found on the posterior aspect of the proximal ends of specimens from Group 73. These are disarticulation marks and indicate a consistency in processing practices not encountered in other phases. The transverse incisions found on the shafts of two complete metatarsi are again likely to be associated with skinning. Two metatarsi from Phase 2 bore chop marks. One has been split open axially to release the marrow. The other has deep marks made with a serrated blade on both the posterior and anterior aspect of the proximal end.

Ten first phalanges bear incisions, mainly on various aspects of the shaft. These are associated with initial skinning. This type of mark is common on all types of Romano-British settlement.

Most butchery marks found on cattle vertebrae were probably made with cleavers. However, none of these resulted in the vertebrae being split down the midline. Several bore superficial marks where the ribs and flanks of the animals had been removed. Others had been chopped through transversely when the backbone was segmented into sections. Again, such butchery has been encountered both on urban and rural sites. Three of the four ribs on which butchery was recorded bore chop marks.

Sheep/goat butchery in G73

Butchery marks were observed on 69 (5%) of the sheep/goat bones, of which 45 were found in G73. This indicates that the carcasses in this large assemblage had been at least partially processed. Most of the butchered sheep/goat bones are the major meat-bearing elements such as the vertebrae, ribs, scapula, pelvis and upper limb bones. Very few of the metapodials in Group 73 have evidence of processing marks and most are largely complete. However, this does not mean that they had not been butchered. Cut marks were observed on three of the eight astragali in this group indicating that the upper hind limbs had been separated from the feet at this point. Knife cuts on two proximal metatarsals, a distal tibia and a calcaneus provide similar evidence for disarticulation at the ankle joint. Incisions were also noted on the posterior aspect of the proximal end of one of the metacarpals.

As discussed above, many of the upper limbs must have been moved elsewhere after initial butchery. Those that were deposited with the foot bones include several with further evidence of butchery. Seven of the scapulae fragments bear marks. One has evidence of a superficial chop mark on the glenoid where it was disarticulated from the humerus. The others have transverse knife cuts on various parts of the medial aspect of the blade, possibly made during separation of the forelimb from the trunk. A humerus has a knife cut just above the distal end on the anterior aspect associated with the separation from the radius and ulna. Superficial chop marks on the medial aspect of the proximal end of a radius reveals a similar process. Two of the pelves bear cuts on the medial aspects of the ilium where they were disarticulated from the vertebral column. Knife cuts were found on the shafts of two femora.

One of the mandibles has two parallel cut marks on the lingual aspect on the diastema and below the third premolar. These could be associated with the removal of the tongue.

Transverse knife cuts were observed on four of the atlases, one of the axes and on two of the other cervical vertebrae. These were made when the sheep were decapitated. Transverse chop marks through two other cervical vertebrae indicate where the neck was segmented from the rest of the vertebrae. No butchery marks were recorded on any of the thoracic vertebrae but knife cuts and chop marks were found on four of the rib heads showing that the ribcages involved had been separated. Six of the ribs have chops or cuts on their shafts usually close to where they have been broken into segments. In all but one case the marks were on the medial aspect indicating that the offal had been removed. Finally, the transverse processes of two lumbar vertebrae were removed when the flanks were separated from the vertebral column.

There is therefore sufficient evidence to suggest that many, if not all, of the sheep represented in G73 had been at least partially butchered. The use of knives by skilled butchers in processing carcasses often leaves few traces on the bones. However, although there is convincing evidence for the segmentation of some of the carcasses with the head, feet, flanks and vertebral column and limb bones divided into separate portions, there is no evidence that the bones deposited in the hypocaust had been cooked or the meat on them consumed. Apart, arguably, from the marks on the femora and the mandible, all the butchery marks are associated with segmentation rather than filleting. There are no charred bones that would indicate spit roasting. Therefore, although a substantial number of these sheep were butchered and the major meat-bearing parts of the carcass removed for consumption elsewhere, there is little evidence that the meat from the carcasses deposited here had been consumed. It is possible that some of the available meat from these carcasses was surplus to requirements.

Other sheep/goat butchery

There is only a small sample available for analysis (Table 19.12). The butchered bones include two horn cores of ewes (both Phase 4) that have been chopped off when the horn was removed for working. Two mandibles (from the same Phase 2 context) have knife cuts on the ramus inflicted when the jaws were separated from the skull. Skinning marks were observed on the top of a skull (Phase 1). Four sets of knife cuts were found on three humeri. Two (Phases 3 and 4) have filleting marks on the shafts; the other two cuts (Phases 2 and 3) are situated at the distal end and were made during disarticulation of the elbow joint. One femur (Phase 1) has knife cuts near the proximal end made when it was separated from the pelvis; a second (Phase 3) has filleting marks on the shaft. Four sets of butchery marks were found on three pelves: two consist of superficial chop marks on the ilium (Phases 1 and 3) made during segmentation from the sacrum; the other two consist of knife cuts (Phases 4 and 5). One tibia (Phase 3) has been chopped through the shaft during segmentation and another from the same phase bears a preparatory knife cut close to where the shaft was broken during segmentation. Two other tibiae (Phase 1 and Phase 4) have knife cuts near the distal end probably made when the feet were removed. Knife cuts on a sheep calcaneus (Phase 5) and the anterior aspect of a proximal metatarsal (Phase 3) also resulted from this process. Knife cuts were found on two ribs (Phases 3 and 4). An axis

(Phase 4) has been chopped through transversely during decapitation. Finally, the transverse processes of two lumbar vertebrae (Phases 2 and 4) were removed when the flanks were separated. Although cleavers were used, knives were the main implements used in butchering sheep/goat carcasses.

Pig

Butchery was recorded on 15 (11%) of the pig bones (Table 19.13). Three of the mandibles (from Phases 1, 3 and 4) have been chopped through the symphysis of the diastema, splitting the jaws. Such butchery is commonly found in Romano-British urban assemblages (Maltby 2010a, 190) but is by no means exclusive to such sites. Examples were recorded at Ruxox, for example (Hamilton-Dyer 2004). A fourth mandible (Phase 1) bears a superficial chop on the ramus. Two atlases (Phase 5) have been chopped through transversely during beheading. A scapula (Phase 4) bears superficial chop marks on the medial aspect of the blade. Cleaver marks were also recorded on two humeri (Phases 2 and 4), both of which have been chopped through the shaft. A femur shaft (Phase 2) has also been chopped through. This bone also has a knife cut near the break made to remove meat from the area preparatory to chopping through the bone. An oblique knife cut on the shaft of another femur (Phase 3) indicates filleting. Heavy blade marks reminiscent of those found on some cattle bones were observed on another pig femur shaft (Phase 4). A pelvis (Phase 4) has an incision on the ischium. A rib head (Phase 4) has been chopped off and a knife cut was found in the same location on a second specimen (Phase 5 G73).

It would appear that cleavers were used more commonly to butcher pig carcasses than they were for sheep. Most of the marks were associated with segmenting the carcasses into joints.

Horse

Only three (5%) of the horse bones bear butchery marks (Table 19.13). A complete radius (Phase 5) has knife cuts on the medial aspect near the proximal end, indicating it had been disarticulated from the humerus. A first phalanx (Phase 5) bears a knife cut on the shaft made during initial skinning. Cut marks were also found on the anterior aspect of the proximal end of a complete third metacarpal (Phase 1), indicating disarticulation of the front feet, perhaps with the skin. There is therefore no conclusive evidence that horsemeat was consumed.

Other Mammals

There is no evidence than any of the dog and cat carcasses have been skinned or butchered. The red deer first phalanx has skinning marks on its shaft and may have been imported with the skin (Table 19.13).

Bird

The only bird bone upon which butchery marks were observed is a goose humerus from G73, which bears knife cuts on the lower part of the shaft (Table 19.13). Butchery of birds often leaves little evidence of processing marks.

Ageing and Sexing Evidence

Cattle

A total of 39 cattle mandibles provide tooth ageing evidence, mainly from Phases 3 and 4 (Table 19.14). Only two (5%) mandibles of neonatal and very young calves (Stages 1-2) are represented. In addition, 21 (2%) of the cattle bones were described as very porous, indicating that they also belonged to very young calves. Five (13%) further mandibles (all from early phases) have only the first molar in wear and are from juvenile cattle under 18 months old and probably under a year old in most cases. In addition to the very porous bones, 45 (5%) cattle bones were recorded as porous and also belonged to calves. Overall, about 10% of the epiphyses of the early epiphyseal fusion group are unfused (Table 19.15), also indicating that some cattle were slaughtered under a year old in all phases. It should be noted, however, that over half of these unfused specimens were found in the hypocaust (G73).

The slaughter of other immature cattle is indicated by the presence of at least eight (21%) mandibles with only the first two molars in wear (Stage 4 – Table 19.14). Again, most of these were found in Phases 1-3. These cattle were probably aged between 18 and 36 months of age. Mandibles of fully mature cattle of over four years of age (Stages 6-7) are poorly represented in the early phases but were found more frequently from Phase 3 onwards. Overall, they provide 43% of the ageable cattle mandibles. Similarly, only 37% of the latest-fusing epiphyses are fused, indicating that the majority of cattle represented are immature.

The prevalence of immature cattle at Newnham, particularly in the earlier deposits contrasts with many Roman assemblages. Urban assemblages tend to have high percentages of adult animals. For example, 75% of the mandibles from later Roman Winchester are at Stages 6-7 (Maltby 2010a, 143). Similar peaks have been found in other assemblages from both large and small towns where mature cows were targeted for slaughter by professional butchers

(Albarella *et al.* 2008, 1837; Maltby 2010a, 288). In a small sample from the settlement complex at Ruxox, 74% of the cattle mandibles were from mature cattle (Hamilton-Dyer 2004, 300). At Kempston Church End 75% of the mandibles were from adult cattle (Roberts 2004). In the small sample from North Brickhill (Maltby forthcoming, b), 60% of the cattle mandibles were at Stages 6-7.

The cattle mandible ageing evidence has greater similarities with the assemblage from Marsh Leys Farm (Table 19.14). There, only 30% of the mandibles from late Iron Age and Roman phases belonged to adult cattle (Stages 6-7). The late Iron Age assemblage from Odell also contains a very high proportion of immature cattle with adult cattle becoming better represented in the early Roman assemblage (Grant 2000: 445, 465). The smaller cattle mandible samples from Clapham (Maltby forthcoming, c) and Biddenham Loop (Maltby 2008) also included only 47% and 46% respectively of cattle mandibles at Stages 6-7. At Marsh Leys Farm, over half the mandibles were from juvenile and immature animals (Stages 3-4) (Maltby 2011). However, this sample did also contain more Stage 3 specimens and more elderly cattle (Stage 7) than at Newnham (Table 19.14). The large percentage of cattle mandibles at Stage 4 amongst the Newnham assemblage perhaps reflects a greater focus on the slaughter of cattle aged between 2-3 years old. These animals were not required for breeding, working and sale elsewhere. This may indicate that the inhabitants at Newnham were sufficiently wealthy to afford to cull or acquire potentially productive immature cattle at a young age for their meat.

Of the five complete metacarpals, two (both Phase 4) possess broad distal breadth to greatest length indices (0.33 and 0.34) indicative of males (Howard 1963). Two others (Phases 3 and 4) are much more gracile having indices of 0.28 and are likely to have belonged to cows. The fifth (Phase 1) has an indeterminate index of 0.30.As discussed below, the assemblage includes some large cattle bones, which indicates that bones of sub-adult and adult oxen and bulls probably form a significant proportion of the cattle assemblage.

Sheep

A total of 111 sheep/goat mandibles provided tooth ageing evidence. These include 48 from G73, which will be considered separately (Table 19.14). There are no mandibles of neonatal animals (Stage 1). Only two very porous bones were recorded indicating that few other bones of neonatal sheep are present. Two mandibles from Phase 4 and two from G73 are, however, from young lambs whose first molars have not fully erupted (Stage 2). These were probably no more than three months old (Jones 2006). About 8% of the bones from G73 and 9% of those from other deposits were described as porous and most of these would have belonged to animals of under six months of age.

The percentage of mandibles with just the first of the molars in wear varies significantly between those found in G73 and those from other contexts. At least 40%, and possibly as many as 69%, of the mandibles from G73 were at this stage of development (Stages 3 and 3-4). These mainly belonged to sheep aged between 6-12 months. Comparable figures for other contexts are substantially lower (22%-36% - Table 19.14). Therefore, although there is evidence that substantial numbers of sheep were culled during the autumn and winter of their first year throughout all the phases, this group seem to have been particularly targeted in G73. Detailed analysis of the wear pattern on the first molars of mandibles in this group (following Jones 2006) would suggest that most of the sheep were culled between six and nine months of age.

Mandibles with two molars in wear (Stage 4) were also found in substantial numbers in all phases. At least 20% of the specimens from G73 and 19% of mandibles from elsewhere are at this stage (Table 19.14).These belonged to sheep mainly culled in their second year. In most cases in the G73 assemblage, the second molar is in an early stage of wear (Grant 1982 stage b) indicating that many of these sheep may have been killed between 12-15 months of age (Jones 2006). In other phases, more of the second molars are at Grant stage d, suggesting they were killed at a slightly older age of around 15-18 months.

Only three (6%) of the mandibles of sheep/goat recovered from G73 have all three molars in wear (Stages 5-7). Adult sheep were clearly not targeted in this cull. In contrast, at least 40% of the mandibles from elsewhere did survive until at least this stage (two years old and above). Of these, 16% are at Stage 5 (2-4 years old). Over 20% of the mandibles therefore belong to sheep over four years old (Stages 6-7). In five (8%) cases, heavy wear was found on the first two molars (Stage 7), indicating they belonged to very mature sheep. Therefore a fair proportion of the sheep at Newnham belonged to animals that would have provided several fleeces of wool and perhaps several lambs before they died.

The epiphyseal fusion data (Table 19.16) broadly support the mandibular ageing evidence. The G73 sample includes a much higher proportion of bones of juvenile lambs than the rest of the assemblage. Only 42% of the earliest fusion group have fused epiphyses and belonged to sheep probably older than a year old. Only 12% of the distal tibiae and metapodials have fused, supporting the contention that the great majority of the sheep represented in this assemblage are from sheep under two years old. Analysis of individual epiphyses in these groups shows some variations. Most of the epiphyses of scapulae and proximal radii have fused, whereas unfused specimens outnumber fused acetabula, distal humeri and proximal first phalanges, confirming observations from previous studies that the epiphyses of the

former fuse earlier than the latter. This adds further support to the assertion that most of the sheep represented in this group were between 6-15 months old.

Only two (3%) of the latest fusing epiphyses in G73 have fused, again indicating that hardly any adult sheep were selected for processing. In the sample from other deposits, 28% of the latest fusing epiphyses have fully fused and belonged to sheep over three years of age. Similarly, 79% of the early fusing epiphyses have fused and two/thirds of the distal tibiae and metapodials have also fused.

Examples of similar discrete accumulations of sheep slaughtered at around the same age are limited, although concentrations of lambs have been found in association with some Romano-British temple sites such as Harlow, Essex (Legge *et al.* 2000; King 2005, Baxter 2011 in press). Relatively high percentages of lambs have also been found on intramural sites in Colchester (Luff 1993) and York (O'Connor 1988), although most of these are younger than those from Newnham. Most sheep/goat mandible assemblages contain much higher percentages of sheep aged over a year old with many surviving until adulthood (Maltby 1981; 2010a, 177-9, 289-290; Grant 2000). This pattern was observed in the small sample at Ruxox (Hamilton-Dyer 2004, 300).

Excluding the assemblage from G73, the sheep/goat mandible ageing profile is broadly similar to that recorded at Marsh Leys Farm (Table 19.14), where high percentages of Stage 3 mandibles were found. There is no clear evidence from these sites that wool production was the primary role of sheep husbandry. Most sheep processed at the Newnham site were immature animals raised principally for their meat, even though metical data suggests wool production was still significant (see below).

Pig

Only 13 mandibles provided tooth eruption evidence (Table 19.14). There is a wide range of ages represented but most pigs were aged between one and three years old. The limited epiphyseal fusion evidence also showed that most of the pigs were immature. Amongst the mandible fragments, four belonged to males and four to females based on the morphology of the canines. One female and three male maxillae were identified. Amongst the loose teeth ten male and just one female canines were recorded.The larger canines of boars are more likely to be recovered than those of sows.

Horse

Only one horse mandible (Phase 4) provided tooth ageing evidence. It belonged to a mature individual, which, based on the crown height of the second premolar (Levine 1982), belonged to an animal of about ten years old. Abnormal wear found on the anterior surface of this tooth indicated that the horse had worn a harness with a bit (Bendrey 2007). The horse skull (Phase 4) also belonged to an adult. Their value as working animals meant that horses could expect to live longer lives than cattle. The epiphyseal fusion evidence is also limited. Most of the epiphyses have fused but a very porous distal humerus belonged to a neonatal or foetal mortality and the presence of an unfused calcaneus, first phalanx, distal radius and fusing proximal tibia and distal tibia indicate that some horses died before becoming fully mature.

Dog

Apart from the partial skeleton of the immature (probably female) dog from Phase 3 G78, there is little information about the life expectancy of dogs at Newnham. There are no bones from neonatal mortalities. Including the jaws from the skeleton, a maxilla and three mandibles are all from adults including one mandible (Phase 4) with heavy wear on its teeth, which must have belonged to an old individual. The abundance of gnawed bones recovered indicates that dogs were kept at the site.

Cat

Both adult and immature cats are represented. The presence of cat tooth marks on some bird bones suggests that cats were resident at the settlement from its earliest phase.

Red Deer

The proximal epiphysis of the first phalanx has fused and belonged to an animal over a year old.

Bird

Four of the domestic fowl bones are porous and belonged to immature birds. Twenty-one others are from adults. Medullary bone was found in the shaft of a tibiotarsus from Group 73, indicating that this bird had been in lay and attests to the exploitation of some chickens for their eggs. Four other shafts of femur and tibiotarsus, however, did not possess any medullary bone. All the bones of the other bird species are from adults.

Metrical Data

The archive contains details of measurements taken on 368 bones recovered from the excavations.

Cattle

Withers height estimates were calculated from the greatest length of limb bones based on the conversion factors of Fock (metapodials) and Matolsci (other limb bones) commonly applied to zooarchaeological specimens (Boessneck and von den Driesch 1978). Calculations were possible on 11 specimens, which provided estimates between 113.3cm and 123.8cm, with a mean of 116.9cm (Table 19.17). These are quite large cattle by Romano-British standards, comparable in size to those found on other sites in south-eastern England, where there is evidence on some sites for improvement in the size of cattle in the early Romano-British period (Albarella *et al*. 2008). Such improvements in cattle do not appear to have been as prevalent in the north and west of the province, where average cattle heights are generally smaller (Maltby 2010a, 292). The sample is too small to determine whether there were variations in size in different phases, although it should perhaps be noted that the largest withers height estimate belonged to a Phase 1 specimen. The mean withers height is smaller than in the sample from Marsh Leys Farm (121.5cm) (Maltby 2011).

Limb bone breadth measurements reflect the overall stature of cattle but are also subject to substantial sexual dimorphism with the limbs of males being generally broader than those of females. Breadth measurements of astragali, proximal metacarpals, proximal metatarsals and distal tibiae are provided in Table 19.17. The mean sizes are all larger than those obtained from the urban assemblages from Winchester and Caerwent. This again indicates that the cattle from Newnham are generally larger than those from Caerwent in particular. This may reflect both differences in stature but also the possible presence of more male cattle in the Newnham assemblage. Urban samples have tended to produce higher percentages of adult female cattle than rural settlements, probably as the result of the procurement policies of the urban butchers (Maltby 2010a, 146-50, 292-3). The presence of large cattle and a good representation of male specimens was also a feature of the Marsh Leys assemblage (Maltby 2011). Some large cattle astragali were also found in later Roman contexts at Ruxox, although the mean distal breadths of cattle tibiae (56.8mm) was smaller than at Newnham (Hamilton-Dyer 2004, 301).

Sheep

Tables 18-19 provide the details of the measurements taken on the sheep metacarpals and metatarsals in G73. The vast majority of these are immature and measurements include those not usually taken on unfused bones. As discussed above, these bones mainly belong to sheep culled between six and 15 months old at a stage prior to the fusion of the distal metapodials. Measurements of the lengths of the unfused bones suggested that most were approaching their full size and it is likely that most of the sheep died shortly before the epiphysis fused. A few smaller and more porous specimens belonged to significantly younger lambs.

Figures 1 and 3 compare the depth (Ddf) and breadth (Bdf) measurements taken at the distal fusion point of the metacarpals and metatarsals from G73 respectively. Nearly all of these are unfused (Tables 19.18 and 19.9). They show a strong positive correlation between the measurements. The smallest specimens separate from the main group represent the bones of the significantly younger lambs. Sheep also display some sexual dimorphism in the breadth of the limb bones, with those of males tending to be stockier than those of females from the same flocks. Comparisons of the shaft lengths against Bdf measurements of the metacarpals and metatarsals (Figs 2 and 4) show less positive correlation and it is tempting to interpret the larger specimens in the metatarsal distribution in particular as males (Fig. 4). If so, it could be that there are fairly even numbers of females and males represented. However, the sheep in this group are all quite large and it is still possible that this was a cull mainly of males considered to be surplus to breeding and wool production requirements. This is significant as it suggests that sheep were kept for their fleeces as well as for their meat. Unfortunately there are too few fused specimens in the rest of the assemblage to provide detailed comparisons. Another possibility to account for size variation is that the sheep were drawn from different flocks. Hornless sheep are not generally found in Iron Age Britain but have been found in varying amounts on Roman settlements and it has been shown that these are sometimes larger than horned specimens (Maltby 2010a, 181-3). At Newnham, sheep horn cores were found in most phases (Table 19.4). Two skull fragments of horned ewes were found in Phases 2 and 4. G73 includes 17 relevant areas of sheep skulls. Six of these are hornless. Of the 11 with evidence for horns, two were tentatively identified as females and two as males, indicating that the metapodial measurements probably also include specimens from both sexes.

Other metrical data obtained from the excavations include 12 distal breadths of tibiae from Phases 2-4. These range between 22.3mm and 26.5mm with a mean of 24.7mm. The average size is therefore quite large by Romano-British standards, slightly smaller than the average size of those in later Roman deposits at Elms Farm, Heybridge, Essex (Albarella *et al*. 2008, 1839) but larger than the average sizes for this measurement obtained from some sites in the west of the province (Maltby 2010a, 295).

Pig

Only five bones of pig were measured. A mandibular third molar (Phase 2) has a greatest length of 38.5mm and is large enough to be considered to be from wild boar, although it is also within the domestic pig range. None of the other measured bones were large enough to be from wild boar. A few other pig bones are from quite large animals but these are more likely to have been from large domestic pigs rather than wild boar.

Horse

It is assumed but not proven that all the equid bones are of horses rather than mules. Measurements were obtained from fourteen bones including five complete limb bones, from which withers height estimates were calculated. These estimates based on Kiesewalter's (1888) conversions of lateral lengths are 123.0cm (Phase 2), 125.0cm (Phase 1), 131.2cm (Phase 3), 132.2 cm (Phase 4) and 134.5cm (Phase 5). This obviously a very limited sample. However, it is interesting to note that the larger specimens are from the later phases. Albarella *et al.* (2008, 1839-40) noted that the average size of horses at Elms Farm increased during the Roman period. In the few cases where it was possible to compare the metrical attributes of the complete horse bones with modern data (Johnstone 2004), the bones more closely matched those of horse than mule.

Dog

Only eight dog bones were measured. None of the limb bones were complete so shoulder heights could not be estimated. A humerus from Phase 3 is from a miniature breed having a distal breadth of only 20.6mm. Dogs of this small size are commonly found on Romano-British sites (Clark 1995) and are often considered to have been pets.

Cat

Four bones of the partial skeleton in G73 were measured. The tibia has a greatest length of 117.8mm and the mandible measures 60.2mm in total length. These fall within measurements obtained from other Romano-British sites, where cats of this size are considered to be domestic.

Birds

Seventeen bones of domestic fowl were measured, of which twelve are from G73. The measurements all fall within the size ranges of domestic fowl found elsewhere in Roman Britain. The seven measured goose bones all fall within the range of grey lag goose (*Anser anser*), with no evidence for the increase in size that is characteristic of some domestic geese in later periods. Similarly, the two measurements from larger duck are no larger than the wild mallard (*Anas platyrhynchos*). The swan carpometacarpus was compared with bones of several specimens of different species of swan in the reference collection. Morphologically it is a very good match for mute swan (*Cygnus olor*) and differs slightly in some morphological details from the humeri of whooper swan (*Cygnus cygnus*) compared. It has a greatest length of 131.6mm, which places it within the lower range of modern mute swan measurements and indicates that it is more likely to be from a female (Bacher 1967). The pigeon humerus (Phase 5) has a greatest length of 48.0mm and a distal breadth of 11.5mm, which makes it a good match for woodpigeon (*Columba palumbus*). The tibiotarsus from Phase 5 measures 56.7mm and falls within the stock dove *(Columba* oenas) and rock dove (*Columba livia*) ranges, which could also include domestic pigeons (Yalden and Albarella 2009: 105-6). However, because of overlaps in the sizes of pigeon and dove skeletons (Tomek and Bochenski 2009), these identifications should be regarded as the most likely species represented rather than definitive identifications. The five corvid bones from G73 are a good match both in morphology and size for jackdaw (*Corvus monedula*) based on the extensive reference collection available.

Pathology and other Abnormalities

Abnormalities were recorded on 62 specimens, details of which are incorporated within the animal bone archive.

Cattle

Most abnormalities were recorded on cattle bones. Perhaps the most significant of these were the pathologies found on the bones of the feet. Lipping and/or exostoses were observed on eight first phalanges, two third phalanges, two proximal metatarsals and two distal metacarpals. Splaying of the distal ends of metacarpals along with other pathological conditions on these and associated phalanges is more common in plough cattle (Bartosiewicz *et al.* 1997). However, minor lesions and lipping can also simply be the result of old age. Nevertheless the incidence of these conditions is greater at Newnham and on other rural settlements in Bedfordshire such as marsh Leys Farm (Maltby 2011) than in urban sites such as Caerwent, which could well indicate that more plough cattle are represented at these sites. Similarly, substantial lipping sometimes associated with other distortions of the glenoid cavity were observed on eight cattle scapulae. Plough animals may have been more susceptible to developing such abnormalities because of the strain in pulling the plough.

Other pathological conditions noted on cattle bones include an abscessed mandible from an old animal, another adult mandible with ante-mortem loss of two premolars, and minor lesions on three tibiae. Three mandibles have third molars with reduced posterior cusps. This congenital condition was first recognised by Andrews and Noddle (1975) and has been quite frequently observed in cattle assemblages from archaeological sites in Britain. At Newnham, 13% of the third molars have this condition, a figure closely comparable with results from Exeter (Maltby 1979, 40). Cattle with this congenital abnormality appear to have been widely distributed around Roman Britain.

Other Species

Various pathological conditions were noted on six sheep/goat mandibles including periodontal disease (two cases), ante-mortem tooth loss, the build-up of excessive calculus (two cases) and abnormal crowding of the cheek teeth. Minor lesions were noted on four metapodials and exostosis was present on the lateral aspect of the proximal articular surface of an ulna. All these conditions could be age-related. It should perhaps be noted there is no evidence of any pathologies on any of the sheep bones in G73, possibly due to their young age. Exostoses and slight distortion of the bone shaft were observed on two pig lateral metapodials. A horse radius has slight exostosis running along part of its shaft. The shafts of the fibula and tibia of a dog have fused together. Finally, the shaft of a domestic fowl tibiotarsus has evidence of pitting and exostosis perhaps indicative of an infection.

IV. Conclusions

The excavations at the Newnham site have produced a faunal sample from a higher-status settlement that adds important new information relating to the exploitation of animals in the region during the Roman period. Analysis of species representation indicates that beef, lamb and mutton were the most frequently consumed meat. The MNE data (Tables 19.3-19.7) indicate that in terms of numbers of animals, more sheep than cattle were consumed at the settlement, although cattle elements were the most commonly recovered in all phases apart from Phase 2 and the abnormal deposit from the Phase 5 hypocaust (G73). There is, however, no conclusive evidence for changes in the relative importance of these species during the period of occupation. Indeed, it is clear that species abundance was to a significant extent dependent upon the types of feature excavated. Boundary features such as enclosure ditches tended to produce more cattle. Assemblages from layers and features associated with domestic occupation tended to produce more sheep.

Cattle bones are an important component of most Romano-British assemblages from all types of settlement, generally increasing in abundance compared with most Iron Age assemblages and being particularly prevalent in towns (Albarella 2007; Albarella *et al*. 2008; Hambleton 1999; King 1999; Maltby 2010a). Cattle have also been the most common species represented in most Roman assemblages investigated from Bedfordshire. The area around the site would have had good potential for cattle pasture.

In a wide ranging survey of bone assemblages from the Roman Empire, King (1999) included 90 samples from Romano-British villas. Although there is a lot of variation between assemblages, the average percentage of cattle from these sites was 56% of the total cattle, sheep/goat (30%) and pig (15%). Excluding the bones from G73, Newnham produced percentages of 52% cattle, 39% sheep/goat and 9% pig. These percentages are identical in the assemblages from Phases 3-4, the period when the villa was flourishing. Therefore, sheep are rather better represented than in most villa assemblages, and pigs less so. It has been noted above that pigs are generally poorly represented in most Iron Age and Roman assemblages from Bedfordshire. High percentages of pig are often associated with high status sites in historic periods and pigs tend to be better represented on more 'Romanised' sites (King 1999). Although still poorly represented, it should be noted that there are slightly higher percentages of pigs from Newnham than from most of the non-villa settlements in the region.

There is no evidence from Newnham that cattle became more important in the later Roman period, as King (1999) has suggested was generally the case at this time. Indeed, it could be argued that the settlement was at one time the location of a commercial operation focused on sheep rather than cattle in the period after the farmstead declined (Phase 5).

Horses are better represented in general on rural sites than on urban sites in Roman Britain (Maltby 2010a, 206), and on the rural sites recently investigated in Bedfordshire, horse bones often outnumber those of pig. In the local context, therefore, horses are poorly represented at Newnham and there is little evidence they were exploited for meat. The percentage of horse to the total horse and cattle counts is only 6%, which is quite low for a Roman rural assemblage particularly in Bedfordshire.

The presence of domestic fowl from Phase 1 is a sign of dietary innovation at the time, although this is not unique to Newnham in this area. The percentage of domestic fowl of the total sheep/goat and domestic fowl bones (excluding G73) lies at just 2%, which is low for a villa assemblage (Maltby 1997). The residents of the farmstead kept dogs and cats, which were allowed regular access to butchery and domestic waste.

There is very little evidence that game provided much of the meat diet at Newnham. There are no bones of roe deer, only a single bone of hare and the red deer bones only represent evidence for the exploitation of deer hides and antler rather than venison. One or two of the largest pig bones may be from wild boar but even here the evidence is equivocal. There are no butchery marks on the badger pelvis. There is no evidence that fish were eaten. Similarly, there are only small numbers of wild bird bones represented. The mallard and goose bones could be from birds kept in captivity, as could one of the pigeon bones. The jackdaw bones are probably from a bird resident around the abandoned buildings. The presence of mute swan is fairly unusual but even if this bird was eaten, dietary diversity is low. Although Newnham was a higher-status site, there is little evidence for much greater diversity in the meat diet than on contemporary sites.

There is abundant evidence for carcass processing, particularly on cattle and sheep. Most of the animals appear to have been slaughtered and butchered at the settlement. Cleavers and knives were both used. There is no evidence that specialist butchers were resident at the site prior to its destruction. However, there is some evidence for Roman influences in carcass processing. Some of the pig jaws had been split open in a manner found frequently in assemblages from Roman towns. Distinctive blade marks associated with filleting were found on several cattle upper limb bones, pelvis and skull fragments. They were most commonly recorded on cattle scapulae but it is possible that some of these are from preserved joints prepared elsewhere by specialist butchers and imported to the settlement.

In Phase 5, G73 produced evidence for large-scale processing of sheep carcasses. The waste from this activity was discarded in the abandoned hypocaust. Sheep, aged between six and twelve months old, were culled in substantial numbers. The presence of horned and hornless sheep may suggest that they were acquired from different flocks, although this does not necessarily have to have been the case. At least 26 sheep are represented in this assemblage, which, judging by its density and good preservation, may have accumulated over a short period of time. The assemblage is dominated by head and foot bones, which were removed from the main meat-bearing parts of the carcass. There is evidence for further carcass segmentation of the upper limb bones and trunks, some (from at least eleven of the sheep) of which were also deposited in the hypocaust. Many of the dressed carcasses, however, were removed for consumption elsewhere. There is no direct evidence that sheepskins were processed here and the fact that the feet and heads were deposited with some of the other parts of the carcass suggests that any skins that were processed were removed elsewhere without any bones attached. The selection of lambs for slaughter in the autumn and winter of their first year is common husbandry practice as this allows animals not required for breeding, milking or wool production to be culled. However, this seems to have been a very focused cull as surplus older animals, which would usually also be commonly killed in the autumn, are not present. The narrow range of ages represented also argues against the possibility that these sheep died as the result of an outbreak of disease. This suggests that meat from lambs of a particular age was required. This deposit may therefore provide evidence that a commercial butchery operation was set up at Newnham for the supply of lamb to other settlements. Earlier assemblages from Newnham also contained relatively high percentages of juvenile lambs, although older animals are commonly represented too.

Evidence for the production and consumption of other animal products was also recovered from the excavations. Cut marks on some first phalanges and skulls show that cattle hides were commonly removed from the carcasses at Newnham for processing. There is also evidence for skinning on horse and red deer phalanges but no evidence that any of the dogs or cats were processed for their skins. Several bone tools and ornaments were recovered and there is evidence for a worked red deer antler offcut. Butchery evidence shows that horns of sheep, goat and cows were sometimes removed for processing. Some of the chickens produced eggs for human consumption.

Ageing data suggests that most of the sheep and pigs and many of the cattle were immature animals raised principally for their meat. There is little evidence that wool production was important. Amongst the older cattle, there is more evidence that ploughing rather than dairy production was important. Relatively large numbers of pathological bones and male cattle, presumably oxen, are represented. The presence of bones of quite young horses suggests that they may have been raised at the settlement. Generally, however they were kept as transport animals, as the evidence for bit wear on one of the mandibles of a mature horse attests.

The cattle are of a good size and generally larger than those of Iron Age date but they were not necessarily larger than cattle found on other settlements in the region. The sheep from G73 are also quite large despite their immaturity, which again supports the contention that meat production was the most important factor in sheep husbandry.

The Newnham excavations have provided an important assemblage that will contribute to broader studies of later prehistoric, Roman and post-Roman animal exploitation in Bedfordshire. It is only by comparing material from a range of sites that a comprehensive understanding of how the pastoral economy was organised can be obtained.

V. Tables

	Phase						
					G73	Other	
	1	**2**	**3**	**4**	**5**	**5**	**Total**
Cattle	134	123	252	253	85	114	961
Sheep/Goat	105	128	162	168	792	85	1440
Pig	23	28	46	36	17	13	163
Horse	12	8	15	17	4	9	65
Dog	2	5	37	5		2	51
Cat	2			2	6	4	14
Red deer		1		1			2
Hare			1				1
Badger				1			1
Domestic fowl	1	1	4	2	21	4	33
Mallard	1				1		2
Other duck		2	1	1	1		5
Goose				1	18	1	20
Mute swan	1						1
Jackdaw					5		5
Pigeon				1		1	2
Total Identified	**281**	**296**	**518**	**488**	**950**	**233**	**2766**
Unid. mammal	231	271	446	527	364	209	2048
Unid. Bird		1	2	3	3		9
Total Undentified	**231**	**272**	**448**	**530**	**367**	**209**	**2057**
Total	**512**	**568**	**966**	**1018**	**1317**	**442**	**4823**
Sheep	10	12	17	24	258	10	331
Goat	1				1		2

Counts are of numbers of individual specimens (NISP)

Table 19.1 Animal bones recorded by phase

	Gnawed								Eroded							
					G73	Other							G73	Other		
	1	**2**	**3**	**4**	**5**	**5**	**Total**	**%**	**1**	**2**	**3**	**4**	**5**	**5**	**Total**	**%**
Cattle	39	44	75	89	9	24	280	40	14	8	19	10	7	8	66	10
Sheep/Goat	27	33	46	41	28	24	199	15	9	13	13	10	42	10	97	8
Pig	9	10	12	7	2	2	42	30	4	4	6	2	1	1	18	13
Horse	3	4	5	4	1	1	18	33	2	1	1				4	7
Dog	1		2				3	6		2	1				3	6
Red deer							0	0				1			1	50
Badger				1			1	100							0	0
Domestic fowl					1		1	3							0	0
Goose					2		2	10							0	0
Total (G or E)	79	91	140	142	40	51	542		29	28	40	23	50	19	188	
Total minus teeth	**256**	**272**	**477**	**454**	**899**	**212**	**2570**		**256**	**272**	**477**	**454**	**899**	**212**	**2570**	
Percentage	31	33	29	31	4	24	21		11	10	8	5	6	9	7	
	Weathered								**Burnt**							
					G73	Other							G73	Other		
	1	**2**	**3**	**4**	**5**	**5**	**Total**	**%**	**1**	**2**	**3**	**4**	**5**	**5**	**Total**	**%**
Cattle	7	11	17	13		5	53	8	1				1	1	3	0.4
Sheep/Goat	3	3	4	3		6	19	1	7	1	2	3			13	0.8
Pig	1	4	1				6	4							0	0
Horse	1	1		1			3	6			1				1	2
Dog							0	0							0	0
Red deer		1					1	50		1					1	50
Total (W or B)	12	20	22	17	0	11	81		8	1	3	3	1	1	17	
Total minus teeth	**256**	**272**	**477**	**454**	**899**	**212**	**2570**		**256**	**272**	**477**	**454**	**899**	**212**	**2570**	
Percentage	5	7	5	4	0	5	3		3	0	1	1	0	0	1	
Unidentified burnt									12	3	10	0	2	1	28	

Counts are of the number of individual specimens (NISP)

Table 19.2 Animal bone preservation

	Phase							Phase						
					G73	Other	NISP					G73	Other	MNE
	1	2	3	4	5	5	Total	1	2	3	4	5	5	Total
Horncore	1	1		4		1	7	1.00	1.00		4.00		1.00	7.00
Maxilla	5	1	10	9	3	2	30	4.00	1.00	6.00	4.00	1.00	1.00	17.00
Skull frag	9	6	20	12	6	4	57	5.00	2.00	9.00	3.00	3.00	2.00	24.00
Mandible	24	13	45	33	10	17	142	8.00	6.00	17.00	10.00	4.00	4.00	49.00
Hyoid	1				1		2					1.00		1.00
Loose teeth	13	10	14	19	2	11	69							
Scapula	10	10	22	30	7	13	92	6.00	6.00	14.00	14.00	5.00	6.00	51.00
Humerus	7	8	9	15	2	6	47	4.00	3.00	2.00	7.00	1.00	4.00	21.00
Radius	3	5	11	16	4	9	48	2.00	4.00	6.00	8.00	2.00	4.00	26.00
Ulna	6	8	9	9	2	5	39	4.00	7.00	6.00	5.00	1.00	2.00	25.00
Pelvis	11	9	13	13	8	2	56	3.00	3.00	5.00	6.00	5.00	1.00	23.00
Femur	5	8	14	19	4	5	55	3.00	3.00	6.00	10.00	3.00	4.00	29.00
Patella						1	1						1.00	1.00
Tibia	15	9	9	12	4	7	56	5.00	4.00	2.00	5.00	2.00	2.00	20.00
Astragalus	1	2	3	7			13	1.00	2.00	3.00	7.00			13.00
Calcaneus	4		7	3	2	1	17	4.00		7.00	3.00	2.00	1.00	17.00
Centroquartal			2	3	1		6			2.00	3.00	1.00		6.00
Metacarpal	4	9	11	4	4	6	38	2.00	7.00	6.00	4.00	4.00	5.00	28.00
Metatarsal	4	6	10	10	3	7	40	1.00	3.00	6.00	6.00	3.00	4.00	23.00
Metapodial		1		1	2	1	5							
Phalanx 1	1	2	9	5	8	5	30	0.25	0.50	2.25	1.25	2.00	1.25	7.50
Phalanx 2		1	3		1	1	6		0.25	0.75		0.25	0.25	1.50
Phalanx 3			5		6	2	13			1.25		1.50	0.50	3.25
Atlas (VC1)	1			2	1	2	6	2.00			4.00	2.00	4.00	12.00
Axis (VC2)	1	1	5	4			11	2.00	2.00	10.00	8.00			22.00
Cervical V		2	5	6		3	16		0.80	1.60	2.40		1.20	6.00
Thoracic V	1	2	5	7	2	2	19	0.13	0.13	0.63	0.88	0.25	0.25	2.27
Lumbar V	3	3	4	3			13	1.00	1.00	1.33	1.00			4.33
Sacral V		1	1	1			3		2.00	2.00	2.00			6.00
Caudal V				1	1		2							
Ribs	4	5	6	5	1	1	22	0.25	0.31	0.38	0.31	0.06	0.06	1.37
Total	**134**	**123**	**252**	**253**	**85**	**114**	**961**	**8.00**	**7.00**	**17.00**	**14.00**	**5.00**	**5.00**	

NISP = number of individual specimens
MNE = minimum number of elements represented

Table 19.3 Cattle element counts

	Phase							Phase						
					G73	Other	NISP					G73	Other	MNE
	1	2	3	4	5	5	Total	1	2	3	4	5	5	Total
Horncore	1	3		2	3	2	11	1.00	2.00		2.00	3.00	2.00	10.00
Maxilla	1	3	1	2	37	2	46	1.00	3.00	1.00	2.00	16.00	1.00	24.00
Skull frag	2		2	5	89	1	99	2.00		1.00	3.00	22.00	1.00	29.00
Mandible	15	17	22	26	112	7	199	9.00	9.00	13.00	15.00	42.00	5.00	93.00
Hyoid		1	1		6	1	9		1.00	1.00		6.00	1.00	9.00
Loose teeth	9	7	15	6	46	8	91							
Scapula	2	4	5	5	31	3	50	1.00	2.00	3.00	2.00	17.00	1.00	26.00
Humerus	6	7	5	7	20	4	49	5.00	7.00	2.00	4.00	14.00	4.00	36.00
Radius	13	20	25	23	27	13	121	6.00	8.00	7.00	8.00	18.00	4.00	51.00
Ulna	3	5	3	6	8	1	26	2.00	3.00	2.00	3.00	6.00	1.00	17.00
Pelvis	1	1	3	2	13	2	22	1.00	1.00	3.00	2.00	7.00	2.00	16.00
Femur	10	6	7	11	17	4	55	4.00	3.00	6.00	7.00	12.00	2.00	34.00
Tibia	18	25	30	22	33	16	144	10.00	11.00	13.00	10.00	21.00	6.00	71.00
Carpals					1		1					0.17		0.17
Astragalus			1		8		9		1.00	1.00		8.00		10.00
Calcaneus				1	16	2	19				1.00	16.00	2.00	19.00
Centroquartal					3		3					3.00		3.00
Metacarpal	10	11	15	20	78	4	138	4.00	6.00	3.00	7.00	52.00	1.00	73.00
Metatarsal	11	12	22	19	72	8	144	3.00	4.00	4.00	4.00	49.00	2.00	66.00
Metapodial				1	5		6							
Phalanx 1	1		3		47		51	0.25		0.75		11.75		12.75
Phalanx 2					8		8					2.00		2.00
Phalanx 3					6		6					1.50		1.50
Atlas (VC1)		1			9		10		2.00			18.00		20.00
Axis (VC2)				2	7		9				4.00	14.00		18.00
Cervical V					19	1	20					7.60	0.40	8.00
Thoracic V					6		6					0.75		0.75
Lumbar V	1	1		2	15		19	0.33	0.33		0.67	3.00		4.33
Sacral V					3		3					6.00		6.00
Ribs	1	4	2	6	47	6	66	0.06	0.25	0.13	0.38	2.94	0.13	3.89
Total	**105**	**128**	**162**	**168**	**792**	**85**	**1440**	**9.00**	**11.00**	**13.00**	**17.00**	**52.00**		

NISP = number of individual specimens
MNE = minimum number of elements represented

Table 19.4 Sheep/goat element counts

	Phase							Phase						
					G73	Other	NISP					G73	Other	MNE
	1	2	3	4	5	5	Total	1	2	3	4	5	5	Total
Maxilla	2		2	1	1		6	1.00		2.00	1.00	1.00		5.00
Skull frag	1	1	2	2	1	1	8	1.00	1.00	2.00	1.00	1.00	1.00	7.00
Mandible	4	7	5	6	2	1	25	1.00	3.00	3.00	5.00	2.00	1.00	15.00
Loose teeth	3	3	10	6	2		24							
Scapula	4		4	2		1	11	3.00		2.00	2.00		1.00	8.00
Humerus	1	4	4	4	1	1	15	1.00	2.00	2.00	3.00	1.00	1.00	10.00
Radius				1			1				1.00			1.00
Ulna	2	2	2	1			7	2.00	2.00	2.00	1.00			7.00
Pelvis	1	1	1	2	1		6	1.00	1.00	1.00	2.00	1.00		6.00
Femur		4	3	2	1	1	11		3.00	3.00	2.00	1.00	1.00	10.00
Tibia	3	2	6	2	1	2	16	2.00	1.00	2.00	2.00	1.00	1.00	9.00
Fibula		1	1	1		1	4		1.00	1.00	1.00		1.00	4.00
Calcaneus			1				1			1.00				1.00
Metacarpal 3-4	1		3	1	1		6	0.50		1.50	0.50	0.50		3.00
Metatarsal 3-4					1	1	2					0.50	0.50	1.00
Peripheral Mp		1	1	2	1	1	6		0.25	0.25	0.50	0.25	0.25	1.50
Phalanx 2					1		1					0.25		0.25
Peripheral Ph1	1						1							
Atlas (VC1)		1			1	1	3		2.00			2.00	2.00	6.00
Axis (VC2)				1			1				2.00			2.00
Cervical V			1				1			0.40				0.40
Thoracic V						1	1						0.13	0.13
Ribs		1		2	2	1	6		0.06		0.13	0.13	0.06	0.38
Total	**23**	**28**	**46**	**36**	**17**	**13**	**163**	**3.00**	**3.00**	**3.00**	**4.00**	**2.00**	**2.00**	

NISP = number of individual specimens
MNE = minimum number of elements represented

Table 19.5 Pig element counts

	Phase							Phase						
					G73	Other	NISP					G73	Other	MNE
	1	2	3	4	5	5	Total	1	2	3	4	5	5	Total
Maxilla	1			1			2	1.00			1.00			2.00
Skull frag				1			1				1.00			1.00
Mandible			2	2			4			1.00	1.00			2.00
Loose teeth		2	2	3	1	2	10							
Scapula		1	1				2		1.00	1.00				2.00
Humerus		1	2			1	4		1.00	2.00			1.00	3.00
Radius	1			1		2	4	1.00			1.00		2.00	2.00
Ulna	1		1			2	4	1.00		1.00			2.00	2.00
Pelvis	2		2	1			5	1.00		2.00	1.00			4.00
Tibia		3	1				4		2.00	1.00				3.00
Calcaneus	1		1	1			3	1.00		1.00	1.00			3.00
Metacarpal 3	1				1		2	1.00				1.00		1.00
Metatarsal 3	1		2	2			5	1.00		2.00	2.00			5.00
Peripheral Mp	1	1		1	1		4	0.25	0.25		0.25	0.25		0.75
Phalanx 1	1		1	2	1	2	7	0.50		0.50	1.00	0.50	1.00	3.50
Cervical V	2						2	0.80						0.80
Thoracic V				1			1				0.13			0.13
Ribs				1			1				0.06			0.06
Total	**12**	**8**	**15**	**17**	**4**	**9**	**65**	**1.00**	**2.00**	**2.00**	**2.00**	**1.00**	**2.00**	

NISP = number of individual specimens
MNE = minimum number of elements represented

Table 19.6 Horse element counts

	Phase							Phase						
			G78	Other		Other	NISP			G78	Other		Other	MNE
	1	2	3	3	4	5	Total	1	2	3	3	4	5	Total
Maxilla		1	1		1		3		1.00	1.00		1.00		3.00
Skull frag	1		1	1	1	1	5	1.00		1.00	1.00	1.00	1.00	5.00
Mandible			2		2		4			2.00		2.00		4.00
Loose teeth		2					2							
Scapula			2				2			2.00				2.00
Humerus	1		1	1	1		4	1.00		1.00	1.00	1.00		4.00
Radius		1					1		1.00					1.00
Ulna			1				1			1.00				1.00
Pelvis			2	1			3			2.00	1.00			3.00
Femur			1	1			2			1.00	1.00			2.00
Tibia			1	3			4			1.00	2.00			3.00
Fibula				1			1				1.00			1.00
Calcaneus				1			1				1.00			1.00
Metacarpal			1				1			0.25				0.25
Metatarsal		1				1	2		0.25				0.25	0.50
Atlas (VC1)			1				1			2.00				2.00
Axis (VC2)			1				1			2.00				2.00
Thoracic V			2				2			0.25				0.25
Ribs			11				11			0.69				0.69
Total	**2**	**5**	**28**	**9**	**5**	**2**	**51**	**1.00**	**1.00**	**2.00**	**2.00**	**2.00**	**1.00**	

NISP = number of individual specimens
MNE = minimum number of elements represented

Table 19.7 Dog element counts

			NISP	
	Cat	Red	Hare	Badger
Antler		1		
Mandible	1			
Humerus	3			
Pelvis				1
Femur	1			
Tibia	5			
Fibula	1			
Metacarpal	1			
Metatarsal	2			
Phalanx 1		1		
Ribs			1	
Total	**14**	**2**	**1**	**1**

NISP = number of individual specimens

Table 19.8 Other mammal element counts

	NISP						
	Domestic fowl	Mallard	Other duck	Goose	Mute swan	Jackdaw	Pigeon
Skull				2			
Mandible	1			4			
Coracoid	3	1		2		1	
Furcula	1			1			
Sternum	1						
Scapula	2		1			1	
Humerus	3			2			1
Radius	4		1	3			
Ulna	2			2			
Carpometacarpus	3	1	1	1	1	1	
Pelvis	1						
Synsacrum							
Femur	3					1	
Tibiotarsus	9		1	1			1
Fibula							
Tarsometatarsus			1	2		1	
Total	**33**	**2**	**5**	**20**	**1**	**5**	**2**

NISP = number of individual specimens

Table 19.9 Bird element counts

	Phase								
					G73	Other	Butch	NISP	
	1	**2**	**3**	**4**	**5**	**5**	**Total**	**Total**	**% Butch**
Horncore				1			1	7	14
Maxilla	1		1				2	30	7
Skull frag	1	1	2		1		5	57	9
Mandible	2	3	7	2	1	2	17	142	12
Hyoid							0	2	0
Scapula	1	1	7	8	3	3	23	92	25
Humerus		1	4	6	1	1	13	47	28
Radius	1	1		1		1	4	48	8
Ulna		2	2				4	39	10
Pelvis	3	1	3	3	1	1	12	56	21
Femur			3	1	1	1	6	55	11
Patella							0	1	0
Tibia		1	3	2		1	7	56	13
Astragalus			1	1			2	13	15
Calcaneus					1		1	17	6
Centroquartal					1		1	6	17
Metacarpal		1		1	3		5	38	13
Metatarsal		1	2	1			4	40	10
Metapodial							0	5	0
Phalanx 1		1	5	1	2		9	30	30
Phalanx 2							0	6	0
Phalanx 3							0	13	0
Atlas (VC1)	1			2		1	4	6	67
Axis (VC2)		1	1	1			3	11	27
Cervical V		1					1	16	6
Thoracic V			1				1	19	5
Lumbar V	2		2	1			5	13	38
Sacral V		1		1			2	3	67
Caudal V							0	2	0
Ribs		1	1	1	1		4	22	18
Total Butch	**12**	**18**	**45**	**34**	**16**	**11**	**136**		
NISP - teeth	121	112	234	239	83	103	892		
% Butchered	10	16	19	14	19	11	15		

NISP = number of individual specimens

Table 19.10 Cattle butchery counts

	Phase						
					G73	Other	Butch
	1	**2**	**3**	**4**	**5**	**5**	**Total**
Horncore				c			c
Maxilla	k		k				2k
Skull frag	b	k c	2b		b		k c 4b
Mandible	2k	4k	5k 3c	2k	c	2k	15k 4c
Scapula	k	b	6k 4c 5b p	6k 2c 8b	c 4b	k 2c	14k 8c 18b p
Humerus		c	3k c	4k 2c	k	k	9k 4c
Radius	k	2k		b		c	3k c b
Ulna		k c	2c				k 3c
Pelvis	k c b	k	2c b	2k b	k	2c	5k 5c 3b
Femur			k 2c b	b	b	c	k 3c 2b
Tibia		b	3k	3c b		c	3k 4c 2b
Astragalus			c	k			k c
Calcaneus					c		c
Centroquartal					k		k
Metacarpal		k		k	3k		5k
Metatarsal		k	2c	k			2k 2c
Phalanx 1		k	6k	k	2k		10k
Atlas (VC1)	k			k c		c	2k 2c
Axis (VC2)		c	c	c			3c
Cervical V		c					c
Thoracic V			k 2c				k 2c
Lumbar V	3c		2c	c			6c
Sacral V		c		c			2c
Ribs		k	c	c	c		k 3c
Total	**7k 4c 2b**	**13k 6c 2b**	**26k 23c 9b p**	**19k 13c 12b**	**8k 4c 6b**	**4k 8c**	**77k 58c 31b p**

k = incision (knife); c = chop mark; b = heavy blade mark; p = perforation
Totals include specimens with more than one type of butchery mark

Table 19.11 Cattle types of butchery marks

	Phase								
					G73	Other	Butch	NISP	
	1	**2**	**3**	**4**	**5**	**5**	**Total**	**Total**	**% Butch**
Horncore				2			2	11	18
Maxilla							0	46	0
Skull frag	1						1	99	1
Mandible		2			1		3	199	2
Hyoid							0	9	0
Scapula					7		7	50	14
Humerus		1	2		1		4	49	8
Radius					1		1	121	1
Ulna							0	26	0
Pelvis			1	1	2	1	5	22	23
Femur	1		1		2		4	55	7
Tibia	1		2	1	1		5	144	3
Carpals							0	1	0
Astragalus					3		3	9	33
Calcaneus					1	1	2	19	11
Centroquartal							0	3	0
Metacarpal					2		2	138	1
Metatarsal			1		2		3	144	2
Metapodial							0	6	0
Phalanx 1							0	51	0
Phalanx 2							0	8	0
Phalanx 3							0	6	0
Atlas (VC1)					4		4	10	40
Axis (VC2)				1	1		2	9	22
Cervical V					5		5	20	25
Thoracic V							0	6	0
Lumbar V		1		1	2		4	19	21
Sacral V							0	3	0
Ribs			1	1	10		12	66	18
Total Butch	**3**	**4**	**8**	**7**	**45**	**2**	**69**		
NISP - teeth	80	121	142	183	746	77	1349		
% Butchered	4	3	6	4	6	3	5		

NISP = number of individual specimens

Table 19.12 Sheep/goat butchery counts

	Species			
	Pig	**Horse**	**Red deer**	**Goose**
Mandible	4			
Hyoid				
Scapula	1			
Humerus	2			1
Radius		1		
Pelvis	1			
Femur	3			
Metacarpal		1		
Phalanx 1		1	1	
Atlas (VC1)	2			
Ribs	2			
Total Butch	**15**	**3**	**1**	**1**
NISP - teeth	139	55	2	20
% Butchered	11	5	50	5

NISP = number of individual specimens

Table 19.13 Butchery counts on other species

	Phase										
					G73	Other	NISP	All Phases		Marsh Leys	
Cattle	**1**	**2**	**3**	**4**	**5**	**5**	**Total**	**Stage %**	**Cum %**	**Stage %**	
Stage 1				1			1	3	3	2	
Stage 2			1				1	3	5	7	
Stage 3	1	2	2				5	13	18	33	
Stage 3-4	1		2				3	8	26	0	
Stage 4	2	2	3	1			8	21	46	22	
Stage 5		1	1	2			4	10	56	7	
Stage 6		1	5	5		2	13	33	90	11	
Stage 6-7					1	1	2	5	95	4	
Stage 7			1	1			2	5	100	15	
Total	4	6	15	10	1	3	39			46	

	Phase										
Sheep/					**G73**	**Other**	**NISP**	**G73**	**G73**	**Other Phases**	
Goat	**1**	**2**	**3**	**4**	**5**	**5**	**Total**	**Stage %**	**Cum %**	**Stage %**	**Cum %**
Stage 1							0	0	0	0	0
Stage 2			1	1	2		4	5	5	3	3
Stage 3	2	1	3	6	19	2	33	40	44	22	25
Stage 3-4		3	3	3	14		23	29	73	14	40
Stage 4	1	2	4	4	10	1	22	5	94	19	59
Stage 4-5	1						1	0	94	2	60
Stage 5	1	2	2	3		2	10	0	94	16	76
Stage 5-6		1	1		1		3	2	96	3	79
Stage 6	3		1	2	2	1	9	5	100	11	90
Stage 6-7	1						1	0	100	2	92
Stage 7	1	2	1	1			5	0	100	8	100
Total	10	11	16	20	48	6	111				

	Phase						
					G73	Other	NISP
Pig	**1**	**2**	**3**	**4**	**5**	**5**	**Total**
Stage 1							0
Stage 2					1		1
Stage 3		1		1			2
Stage 4							0
Stage 4-5	1			1			2
Stage 5	1		2	1			4
Stage 6		2		1			3
Stage 7		1					1
Total	2	4	2	4	1	0	13

Stage 1 = 4th deciduous premolars (dp4) not in wear
Stage 2 = dp4 in wear; 1st molar (M1) not in wear
Stage 3 = M1 in wear; 2nd molar (M2) not in wear
Stage 4 = M2 in wear; 3rd molar (M3) and permanent premolars not in wear
Stage 5 = M3 in wear; 4th permanent premolar (P4) not in wear (Cattle)
Stage 5 = M3 in wear; M1 at Grant (1982) wear stage g (S/G)
Stage 5 = P4 in wear; M3 not in wear (Pig)
Stage 6 = P4 in wear; M3 < Grant wear stage k (Cattle)
Stage 6 = M1 at Grant wear stages h-m; M2 at Grant wear stage g (S/G)
Stage 6 = M3 at Grant wear stages a-b (Pig)
Stage 7 = M3 at Grant wear stages k-m (Cattle)
Stage 7 = M1 and M2 at Grant wear stages h-m (S/G)
Stage 7 = M3 at Grant wear stages c-g (Pig)

Table 19.14 Cattle, sheep/goat and pig mandibular tooth ageing data

	Phase														
	1		2		3		4		5 G73		5 Other		Total		
Early Fusing	**U**	**F**	**U**	**F**	**U**	**F**	**U**	**F**	**U**	**F**	**U**	**F**	**U**	**F**	**%F**
Radius P		1		4		6	1	7	1	1		3	2	22	91.7
Scapula D		1		4		9		6		4		3	0	27	100.0
Acetabulum		2		2	1	2		2	1	3			2	11	84.6
Humerus D							1	6	1				2	6	75.0
1st Phalanx P	1			2		9		5	3	5	1	3	5	24	82.8
2nd Phalanx P				1		3				1		1	0	6	100.0
Total	**1**	**4**	**0**	**13**	**1**	**29**	**2**	**26**	**6**	**14**	**1**	**10**	**11**	**96**	**89.7**
Later Fusing													0	0	
Tibia D		4	2	2	1	1	1	2				1	4	10	71.4
Metacarpal D			5			1		4	4		3		12	5	29.4
Metatarsal D	2			1	1	1	1	2	2			2	6	6	50.0
Metapodial D			1				1		2				4	0	0.0
Total	**2**	**4**	**8**	**3**	**2**	**3**	**3**	**8**	**8**	**0**	**3**	**3**	**26**	**21**	**44.7**
Latest Fusing															
Ulna P			1		1		1	1					3	1	25.0
Femur D	1			1	2	2	5		1				9	3	25.0
Radius D		1	1	1	3		3	2		1		1	7	6	46.2
Humerus P				1					1				1	1	50.0
Femur P					4		3	2	1			1	8	3	27.3
Calcaneus P					2	1	2			1			4	2	33.3
Tibia P	2	1	1		1	1		2	1	1		1	5	6	54.5
Total	**3**	**2**	**3**	**3**	**13**	**4**	**14**	**7**	**4**	**3**	**0**	**3**	**37**	**22**	**37.3**
Vertebrae Cn	3	1	3	4	8	7	11	10	3		4		32	22	40.7
Vertebrae Cd	5		3	4	11	3	13	6	2		5		39	13	25.0
Rib	1		2	2	1	2							4	4	50.0

P = proximal; D = distal; Cn = cranial; Cd = caudal; U = unfused; F = fused
Unfused includes specimens that are just fusing (> 50% of fusion line visible)

Table 19.15 Cattle epiphyseal fusion data

	Phase													Other		
	1		2		3		4		5 G73		5 Other		5 G73			
Early fusing	**U**	**F**	**U**	**F**	**U**	**F**	**U**	**F**	**U**	**F**	**U**	**F**	**%F**	**U**	**F**	**%F**
Radius P		1		1		4	1	2	5	13		4	72.2	1	12	92.3
Scapula D	1								3	11			78.6	1	0	0.0
Acetabulum		1				1		1	5	3			37.5	0	3	100.0
Humerus D				1	1	1			8	2		1	20.0	1	3	75.0
1st Phalanx P	1				1	1			35	11			23.9	2	1	33.3
2nd Phalanx P									4	4			50.0	0	0	
Total	**2**	**2**	**0**	**2**	**2**	**7**	**1**	**3**	**60**	**44**	**0**	**5**	**42.3**	**5**	**19**	**79.2**
Later fusing																
Tibia D	2	2	2	3	1	4		3	15	3			16.7	5	12	70.6
Metacarpal D	1			1	1		1	2	43	5			10.4	3	3	50.0
Metatarsal D		2			1				38	6			13.6	1	2	66.7
Metapodial D								1	4				0.0	0	1	100.0
Total	**3**	**4**	**2**	**4**	**3**	**4**	**1**	**6**	**100**	**14**	**0**	**0**	**12.3**	**9**	**18**	**66.7**
Latest fusing																
Ulna P	1								2				0.0	1	0	0.0
Femur D	1						2		11				0.0	3	0	0.0
Radius D	1		1					3	17	1			5.6	2	3	60.0
Humerus P									9				0.0	0	0	
Femur P	1		1		1		2		8				0.0	5	0	0.0
Calcaneus P							1		14			2	0.0	1	2	66.7
Tibia P					1				8	1			11.1	1	0	0.0
Total	**4**	**0**	**2**	**0**	**2**	**0**	**5**	**3**	**69**	**2**	**0**	**2**	**2.8**	**13**	**5**	**27.8**
Vertebrae Cn	1			1			1	3	38	9		1	19.1	2	5	71.4
Vertebrae Cd	1			1			3	1	44	2		1	4.3	4	3	42.9
Rib			2			1	1		24	1	4	2	4.0	7	3	30.0

P = proximal; D = distal; Cn = cranial; Cd = caudal; U = unfused; F = fused
Unfused includes specimens that are just fusing (> 50% of fusion line visible)

Table 19.16 Sheep/goat epiphyseal fusion data

Measurements (mm)					
Cattle	**Mean**	**sd**	**cv**	**Winch mean**	**Caer mean**
Astragalus Bd	*41.3* 41.6 42.5 **44.4** **49.0** 36.0 38.8 40.5 41.7 47.0 47.8	42.8	4.0	9.3	35.4	37.1
Astragalus GLl	*59.6* 65.8 **62.5** **68.9** 58.3 62.7 64.7 67.7 69.7 74.8	65.5	5.0	7.6	63.5	58.8
Metacarpal Bp	*54.4* 54.1 61.9 **52.0** **55.9** 53.7 61.9 **55.4** **75.1**	58.3	7.2	12.3	55.0	50.6
Metatarsal Bp	37.4 **41.8** **47.1** **49.7** **56.3** 43.9 45.8 46.1 47.4 48.8 51.8 **45.9** **47.6**	46.9	4.6	9.8	43.8	42.1
Scapula LG	50.1 59.8 **53.9** **67.8** **70.9** 51.1 60.3 **51.3** **52.2** **54.0** **54.1**	56.9	7.0	12.3	56.1	50.6
Tibia Bd	*53.1* *55.2* *60.2* *60.7* 55.5 69.7 **57.1** 64.6 **55.4**	59.1	5.3	9.0	57.0	54.5
Withers Ht (cm)	*123.8* 114.5 115.0 117.0 **117.0** 113.3 113.9 116.6 118.2 **113.9** **122.6**	116.9	3.5	3.0	116.7	109.7

Bp = proximal breadth; Bd = distal breadth
GLl = greatest lateral length; LG = length glenoid cavity
Withers height estimated from length measurements of complete limb bones
Italics = Phase 1; Normal font = Phase 2; **Bold** = Phase 3; Underlined = Phase 4; **Bold/Underlined** = Phase 5
Winch = Winchester late Roman; Caer = Caerwent (data from Maltby 2010a)

Table 19.17 Common measurements of cattle

Bp	Dp	Bd	Bfd	Dfd	SD	GL	Ldj	Notes		Bp	Dp	Bd	Bfd	Dfd	SD	GL	Ldj	Notes
22.6	16.4													13.9		139.6	128.8	
21.9	16.4		24.5	15.7			103.7	DU		22.9	17.1		25.0	16.3			109.2	
			25.5	13.6				DF		23.9	17.6		27.0	16.9			115.4	DU
18.2	12.7		20.3	12.9			70.7	DUP					24.3	15.3				DU
			28.9	17.4				DU					24.4	14.4				DU
			23.8	14.0				DU		22.7	16.2		25.5	14.6			99.4	DU
24.1	17.3		26.3	17.1			119.3	DU		18.4	12.5		20.4	13.1			71.3	DUP
22.0	16.0		25.9	15.9			104.1	DU		19.6	15.4							IMM
24.2	16.4		26.6	17.5			114.7	DU		23.1	16.6							
21.5	15.7		24.9	15.1			102.4	DU		24.0	17.3							
25.9	18.4									23.9	17.9		27.5	16.7			115.5	DU
21.0	15.5		23.0	15.1			99.8	DU		22.5	16.7		26.0	15.0			102.9	DU
20.3	14.8									19.9	14.7		21.7	14.4			100.8	DU
22.8	16.7									23.2	17.1		29.5	17.0			112.0	DU
			26.5	15.8				DU		24.1	16.4							
23.1	16.7		27.1	16.6			104.2	DU		24.9	17.3							
			30.3	18.8				DU		24.2	17.9		28.1	18.9			112.7	DU
			23.5	15.1				DU		21.5	15.9		22.7	14.3			101.2	DU
23.4	15.9												23.5	15.8				DU
21.3	16.4	23.0	23.7	13.3	12.1		105.0			20.8	15.5		24.4	15.0			92.6	DU
20.9	15.5		25.6	15.7			99.5	DU		22.0	16.0		25.0	14.8			104.0	DU
22.5	15.9		24.1	15.4			101.0	DU		24.3	17.8		27.9	19.5			111.5	DU
24.2	17.0						99.5	DU		21.1	15.0		22.2	14.1			98.6	DU
21.7	16.4						103.2	DU		21.7	15.5						100.9	DU
23.6			24.7	14.9			106.5	DU					26.9	16.2				DU
21.9	15.6						100.4	DU		22.7	15.2							
			23.8	13.8				DU		19.0	14.3							IMM?
23.6	17.1									20.0	15.2							IMM
		23.0		23.9									24.8	15.8				DU
		24.5	24.6	13.1														

	N	Min	Max	Mean	sd	cv	Skew
Bp	44	18.2	25.9	22.3	1.8	7.88	-0.47
Dp	43	12.5	18.4	16.1	1.2	7.62	-0.89
Bfd	39	20.3	30.3	25.1	2.2	8.92	0.08
Dfd	41	12.9	23.9	15.7	2.1	13.1	1.77
Ldj	30	70.7	128.8	103.6	11.4	11.0	-1.05

Bp = proximal breadth; Dp= proximal depth; Bd = distal breadth; Bfd= breadth distal fusion point
Ddf = depth distal fusion point; SD = minimum shaft breadth; GL = greatest length
Ldj = length to distal fusion point; DU = unfused distal epiphysis; P = porous
IMM = immature (distal probably unfused)

Table 19.18 Sheep metacarpal measurements from Group 73 (Phase 5)

Bp	Bd	Bfd	Dfd	GL	SD	Ldj	Notes		Bp	Bd	Bfd	Dfd	GL	SD	Ldj	Notes
21.0									20.5		21.8	15.3			117.3	DU
20.2	23.8	22.9	13.8	134.4	11.2	124.0	DF				24	15.6				DU
21.4		24.3	15.8			112.6	DU		20.7							
18.4		22.7	14.5			112.9	DU		16.1		18.9	12.4			74.3	DUP
20.9		23.4	14.6			117.0	DU				24.8	15.4				DU
21.6											26.6	18				DU
		29.2	17.8				DU		22.2		24.9	15.8			141.3	DU
		25.6	15.8				DU		18.4							
	23.8	22.8	13.8				DF				22.8	15.1			121.5	DU
20.1		23.1	14.7			110.9	DU		17.6							IMM
21.1		23	14.4			116.8	DU		19.7		22.2	14.3			109.2	DU
20.7									21.5							
21.4		25.9	16.7			126.4	DU				24.6	15.7				DU
		27.4	17				DU		20.5							
	21.9	21.8	12.7	125.0	10.8	115.0	DF		18.1	22	21.6	12.6	127	10.9	115.4	DF
22.3		25.8	16.6			116.0	DU		21.4		25.2	16.1			103.6	DU
18.5		20.5	14			109.8	DU				21.9	14.1				DU
17.2									20.8		27.1	16.7			122.0	DU
21.3		24.7	16			104.5	DU		21.4							
		25.5	17.8				DU				22.2	15.8				DU
21.4		25.1	16.3			130.5	DU		20.3							
20.1	23.8	23.2	13.6	135.4		124.0			19.7							
18.4							IMM				22.3	14.6				DU
21.2											24.6	15.6				DU
19.6							IMM				23.4	15.2				DU
16.2							P		21.2		26.6	16.1			125.7	DU
20.8		24.3	15.2			110.0	DU		21.6		27.7	15.7			124.6	DU
20.1											20.4	14.4				DU
		25	15.8				DU		20.5	23.7	23	14	144.6	12.2	132.4	DF
		23.4	15.1				DU									

	N	Min	Max	Mean	sd	cv	Skew
Bp	24	16.2	23.7	20.4	1.7	8.2	-0.8
Bfd	42	18.9	29.2	24.0	2.1	8.8	0.1
Dfd	42	12.4	18.0	15.3	1.3	8.7	-0.1

Bp = proximal breadth; Bd = distal breadth; Bfd = breadth distal fusion point
Ddf = depth distal fusion point; SD = minimum shaft breadth; GL = greatest length
Ldj = length to distal fusion point; DU = unfused distal epiphysis; P = porous
IMM = immature (distal probably unfused)

Table 19.19 Sheep metatarsal measurements from Group 73 (Phase 5)